OGY DEPARTMENT

ROADS AND STREETS

JULY 1947

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Saving seconds on every batch enables the Koehring 34-E twinbatch paver to save hours on every job — with Timken Tapered Roller Bearings reducing friction; carrying radial, thrust and combined loads; simplifying lubrication; cutting maintenance.

All the drum rollers in this paver are mounted on Timken Bearings which also are used in the traction transmission unit and reduction case unit.

Construction equipment nowadays isn't bought by the job. It is selected for its ability to produce profits on many jobs. That's why so many contractors make "Timken Bearing Equipped" a condition of purchase. They know it signifies better performance, longer equipment life, lower cost. The Timken Roller Bearing Company, Canton 6, Ohio.

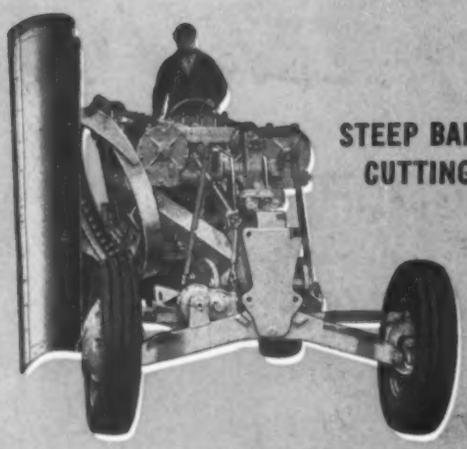
A tip—look for the trade-mark "TIMKEN" on every bearing that goes in your machines.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

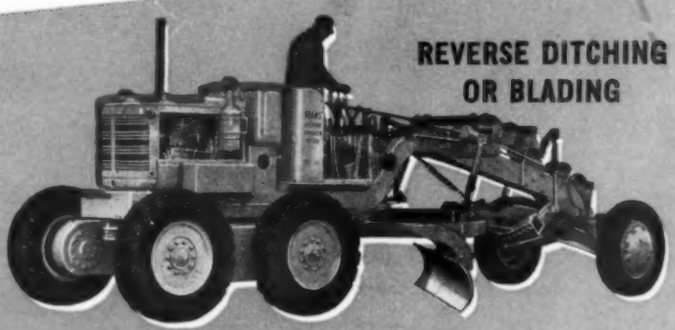
NOT JUST A BALL ○ NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER — BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION

R v. 902 July-Dec. 1947

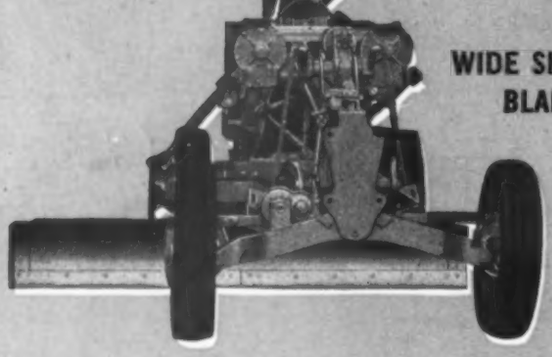
Adams Motor Graders
Your best buy—all ways



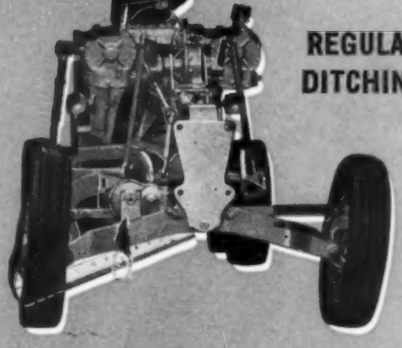
STEEP BANK CUTTING



REVERSE DITCHING OR BLADING



WIDE SHOULDER BLADING



REGULAR DITCHING

More Blade Positions
WITHOUT MECHANICAL ADJUSTMENTS

● Adams fast power-operated mechanical control system gives you the full range of blade positions shown above . . . *with blade centered on circle—without adjusting blade lift links.*

This important Adams advantage permits operator to obtain *all* average blade positions through simple maneuvering of the control levers—*without leaving the cab.* Even on more extreme work (which is seldom encountered) required blade positions are quickly obtained through easy adjustment of the telescopic lift links. Rarely is work so extreme that blade must be shifted on circle.

Here you have one more specific example of how Adams Motor Graders speed operations—reduce operator fatigue—improve work—lower operating costs. Ask your local dealer to demonstrate how Adams Motor Graders are *your best buy—in this way—and all ways.*

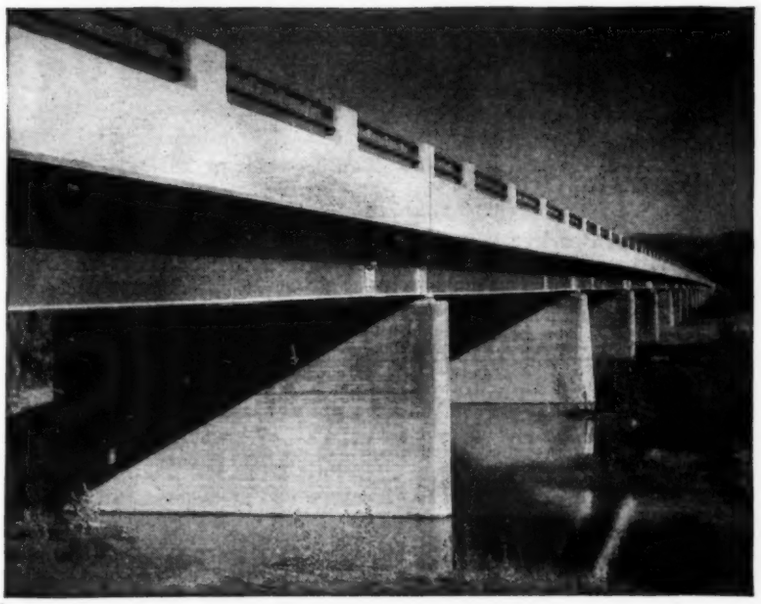
J. D. ADAMS MANUFACTURING CO. • INDIANAPOLIS, INDIANA

Adams

MOTOR GRADERS • LEANING WHEEL GRADERS • ELEVATING GRADERS

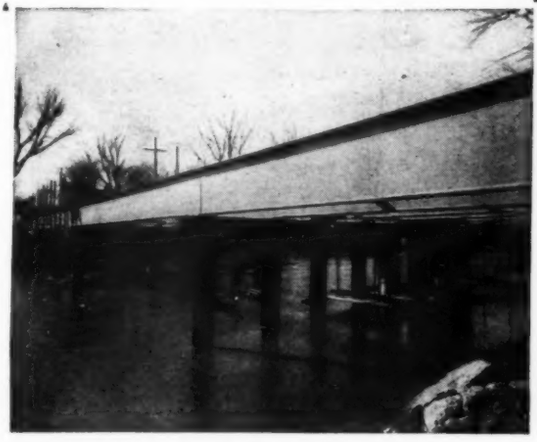
Tech

STEEL for Highway Bridges by BETHLEHEM



What are your needs in highway bridge-building? Whether it's to be an all-steel bridge, or reinforced concrete, or concrete-and-steel, you can count on Bethlehem supplying all the steel that the designs require.

Structural steel . . . reinforcing bars . . . reinforcing trusses . . . steel "Battledeck Floor" . . . single and multiple-strand bridge cable and suspender wire ropes . . . steel-sheet piling and steel H-piling . . . these and many other steel products for bridge-building are supplied through the nearest Bethlehem district office, or through Bethlehem Steel Company, Bethlehem, Pa.



STEEL SHEET PILING

There are many applications for Bethlehem Steel Sheet Piling in the construction of highway bridges. Use it in temporary cofferdams, in the construction of bridge foundations, and in abutments and retaining walls. This piling is rolled in a wide range of sections, including straight, arch and deep-web, and Z-type sections.

STEEL H-PILING

Steel H-Piles have high column strength. They are used to best advantage in locations where they can be driven into hard ground material such as hard-pan or shale or to firm bearing on solid rock. In such cases extremely high bearing capacities can be developed.

Bethlehem Steel H-Piles are special wide-flange structural steel shapes having web and flanges of the same thickness. They are used in bridge foundations in the same manner as other types of bearing piles.

"BATTLEDECK FLOOR"

Steel "Battledeck Floor" is as light as timber but more durable than concrete. Where traffic is heavy or the bridge span of considerable length, the weight of the flooring will naturally be an important factor in the cost of the steel structure required to carry it. In such cases "Battledeck Floor" should be given full consideration.

"Battledeck Floor" has an advantage over other steel floors designed for lightness in that it is not composed of thin sections. It consists of standard rolled beams, placed lengthwise of the traffic, with a flat plate of substantial thickness welded over these beams. It is therefore assured of a life as long as that of the bridge which supports it.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

STEEL FOR HIGHWAYS

Road Joints — Reinforcing Bars — Bar Mats
Guard Rail — Guard Rail Posts and Fittings
Wire Rope — Hollow Drill Steel
Fabricated Structural Steel — Sheet and H-Piling
Spikes — Bolts and Nuts — Tie-Rods
Timber Bridge Hardware

BETHLEHEM STEEL

ROADS AND STREETS

JULY, 1947 • VOL. 90 • No. 7

With Roads and Streets Have Been Combined Good Roads Magazine And Engineering & Contracting

Coming Articles

How Atkinson Services 70 Big Earth Rigs

Job tricks seen in an unusual field shop and yard at San Francisco airport, where Guy F. Atkinson & Co. has 80 mechanics and service men on a streamlined routine

What's Doing on City Street Work?

A round-up of reports from typical cities—arterial modernization, surface treatment and repairs, and other street work that will total hundreds of millions this year

Autumn and Winter Problems

What several northern counties experienced last winter and are planning to do this winter about ice control, snow removal and general roadway preparation!

Lime Stabilization for Low Cost Roads

Summary of recent Texas practice—we've held this interesting article several months waiting its turn. You should see it next month

Contractors at Work

D. R. Smalley and Sons of Ohio, on U. S. 40, and other selected paving and grading projects—continuing this popular series

Soils Studies and Foundation Design for Los Angeles' 4-Level Expressway Interchange

How preliminary drainage and soils investigations were conducted, utilization of poor soil planned, and pavement and structure foundations designed for elaborate $1,500,000 separation and approaches

Also Soon

Cost Estimating Method for Aggregate Production Projects . . . Repairing a Bascule Span . . . Tests for Uniformity of Air Entrainment, Chicago Street Paving . . . The Pros and Cons of Toll Roads . . . Cost Accounting Plan for County Roads . . . More "Job and Equipment Ideas."

HAROLD J. MCKEEVER, Editor
C. T. MURRAY, Managing Editor
H. K. GLIDDEN, Contributing Editor
V. J. BROWN, Consulting Editor

In This Issue

Joint Sealing Costs Cut 42%..... 51
By H. L. Cooper, Asst. Maintenance Engineer, California Division of Highways

War Surplus vs. New Models vs. Job Profits..... 55

Editorials 56

Contractors at Work..... 59
Ballenger Paving Co., US 1 N. Carolina
How Max Zeller Placed Bituminous Widening in Ohio
By Fred W. Kimble, Engr. of Bituminous Construction, Ohio Dept. of Highways

Houston Expressways—Design of Earth and Pavement Structures... 69
By W. J. Van London, Engr.-Mgr. Urban Houston Expressways, J. C. Dingwall, Urban Planning Engineer, F. A. Harris, Soils Engineer

2-Way Radio Now Available..... 86

Clearing Airports by New Snow-Plowing Method..... 87
By J. R. Shannon, Snow Removal Engineer, Four Wheel Drive Auto Co.

Traffic Safety Program Credited with Saving Lives..... 90

Construction Equipment Maintenance:

Crawler Tracks—Their Lubrication and Maintenance..... 94
By K. L. Hollister and E. V. Albert, Technical and Research Divn., The Texas Company

New Equipment and Materials..... 99

Manufacturers' Literature 104

With the Manufacturers..... 107

Clearing House 110

A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

Gillette Publishing Company
Publication and Editorial Offices,
22 West Maple Street, Chicago 10, Ill.

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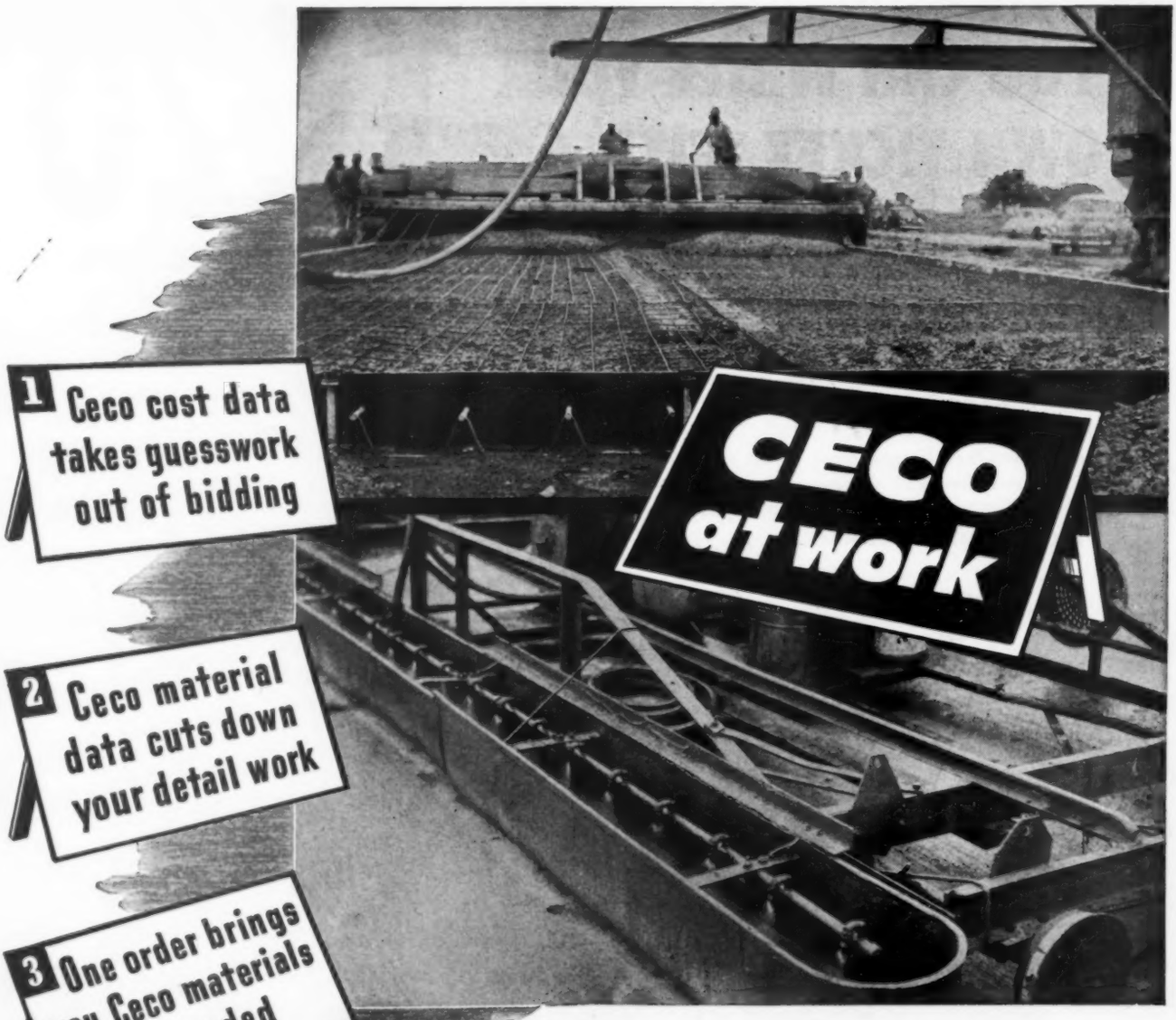
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Asphalt plant

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THOUSANDS of dollars' worth of equipment depending on delivery from the asphalt plant! If the asphalt plant goes "down" the job is dead.

When your investment depends on feeding a plant like this, you can't afford anything but the best. You need a Northwest Crane!

See a Northwest at work! Talk to Northwest Owners! Note their enthusiasm and satisfaction.

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Northwests keep materials flowing and keep the outfit running. Plan now to have a Northwest on those jobs ahead.

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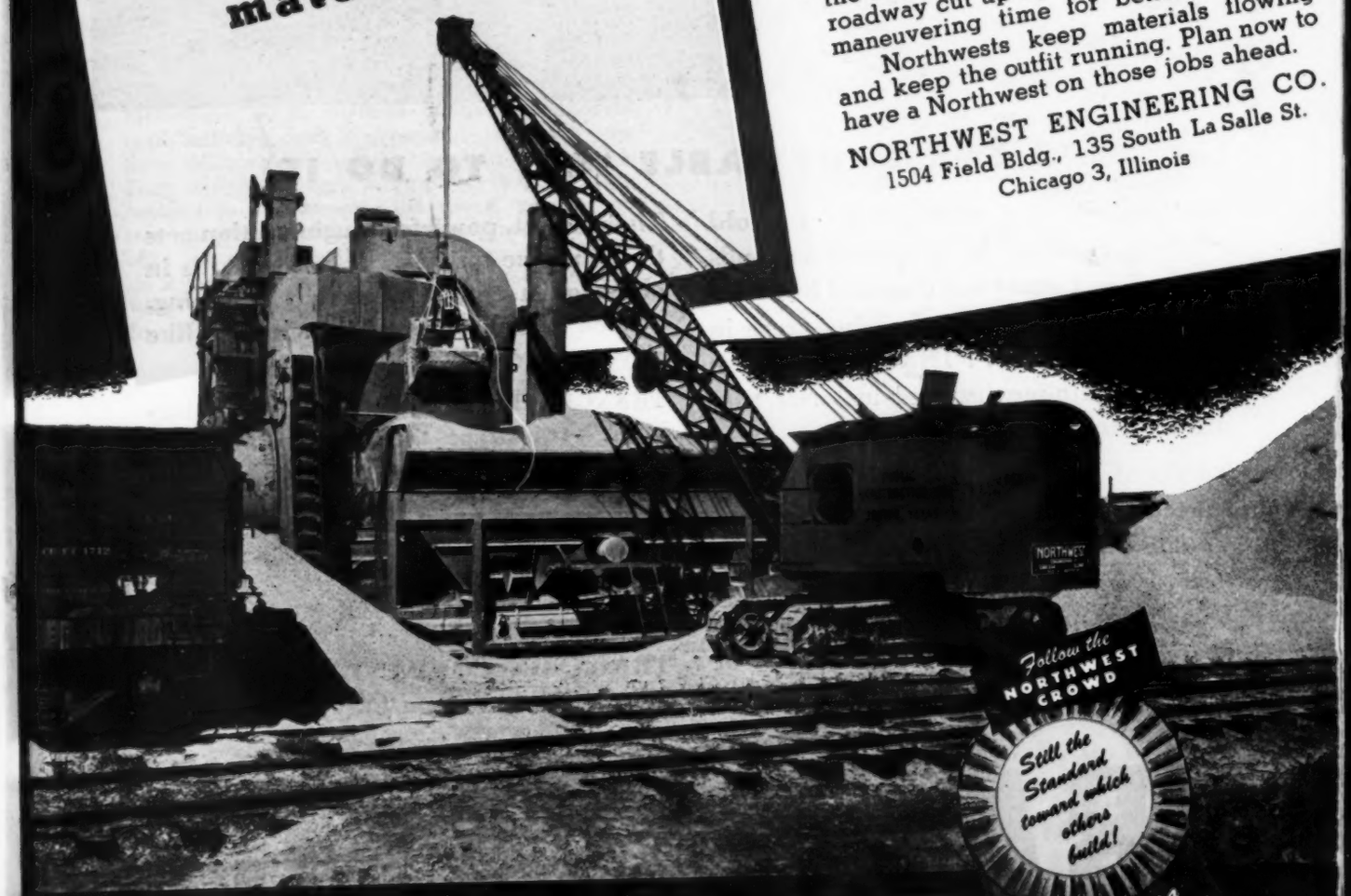
Chicago 3, Illinois



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Still the Standard toward which others build!

If you have a REAL ROCK SHOVEL you won't have to worry about output in dirt

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TRAXCAVATORS, powered by "Caterpillar" track-type tractors, are available in four sizes with bucket capacities from ½ to 2½ cubic yards. There's a size for every job and purpose. See your TRACKSON-"Caterpillar" dealer about time-and-money-saving ways to use TRAXCAVATORS, or write direct to TRACKSON COMPANY, Dept. RS-77, Milwaukee 1, Wisconsin.

TRAXCAVATOR

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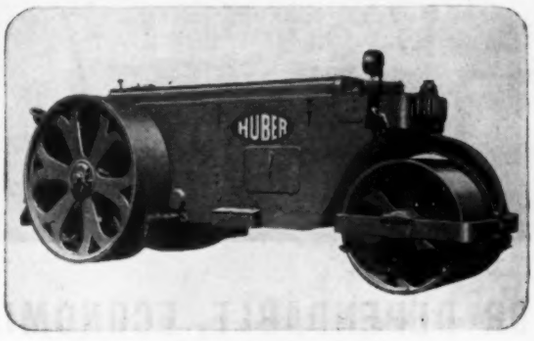
The Original Tractor Excavator

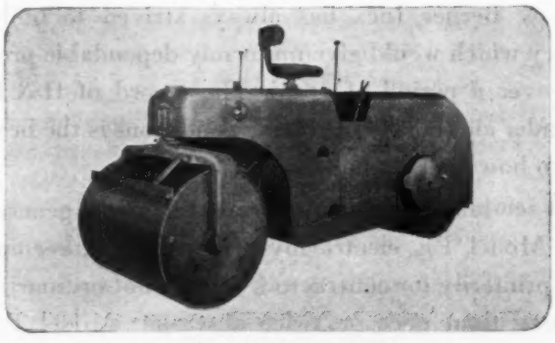
WHAT INTERESTS YOU MOST IN A ROAD ROLLER OR MAINTAINER?

Isn't it ability and capacity to do the jobs for which they are intended quickly and at the lowest possible cost?

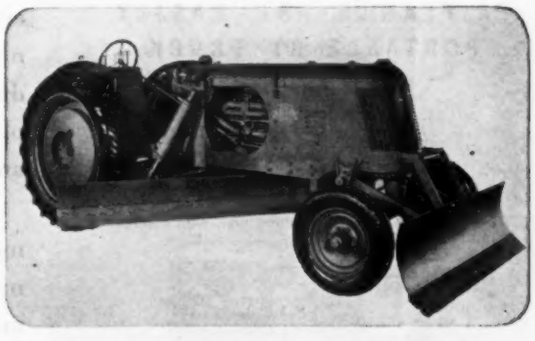
Then look no further than Huber 3-Wheel Rollers, Huber Tandem Rollers, and the popular Huber Maintainer, for in all three of these dependable road building and maintenance machines you have the very things for which you are looking. They have the simple design that reduces maintenance to a minimum; the speed, power, and stamina to make short work of any road job, and offer the maximum in operating economy based on a thorough knowledge of your requirements. Why not talk this over with your Huber Distributor?



HUBER 3-Wheel ROLLERS
Automotive type, built in sizes from 5 to 12 ton.



HUBER TANDEM ROLLERS
Variable weight, built in sizes from 3 to 12 ton.



HUBER MAINTAINER—A versatile machine that also serves as a bulldozer, lift-loader, patch roller, snowplow, or rotary boom.

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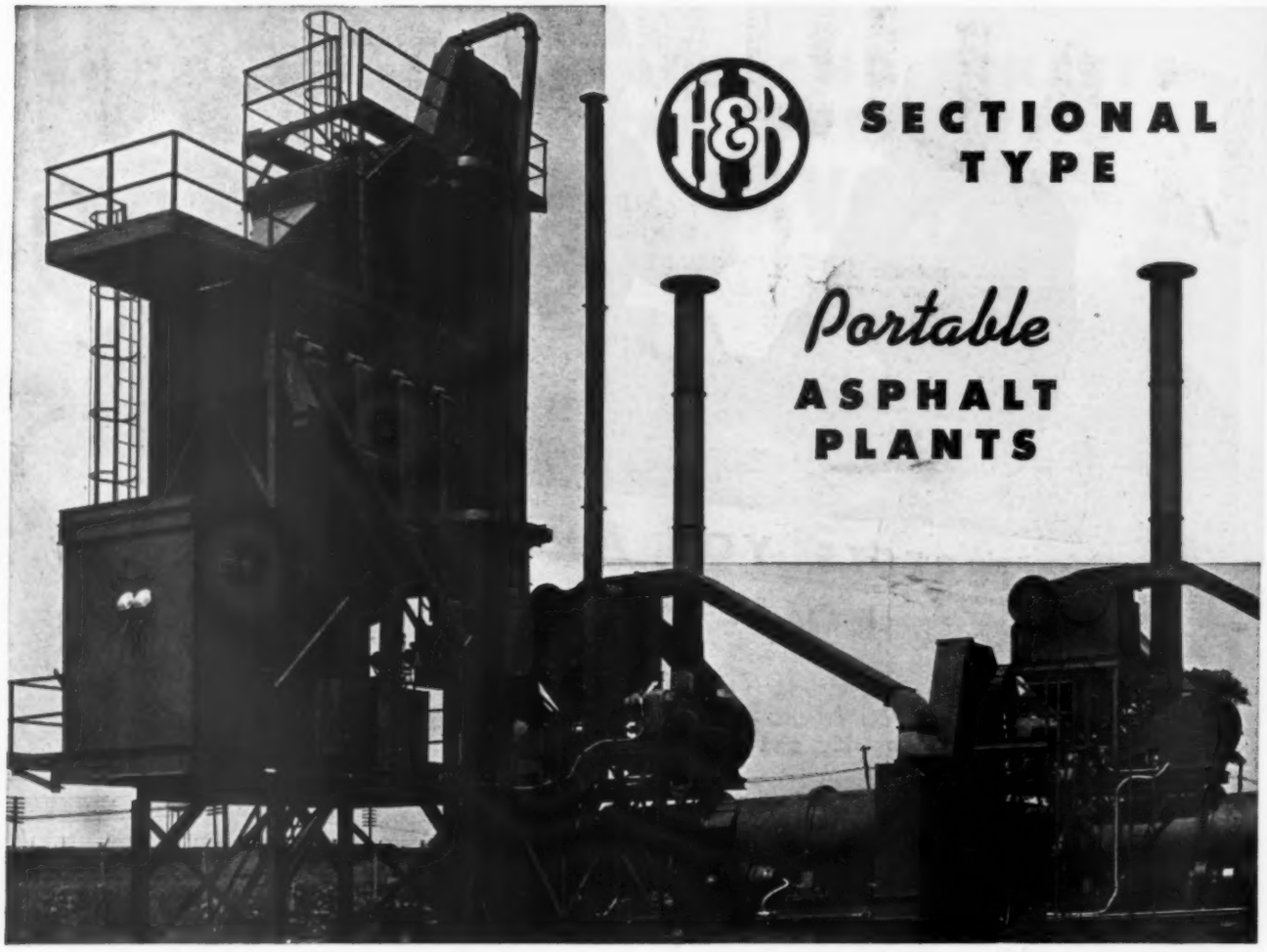
3 Wheel • Tandem
ROAD ROLLERS *and* MAINTAINERS



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H & B sectional type plants are built in two general models: Model PE electrically-driven plants, recommended primarily for contractors who do not ordinarily move more than once or twice a season; Model PA plants, designed primarily for the contractor who moves frequently and who must be able to get efficient production on small as well as large jobs, and under a wide variety of operating conditions.

Bulletin P-46, describing both PE and PA plants, will be sent on request.

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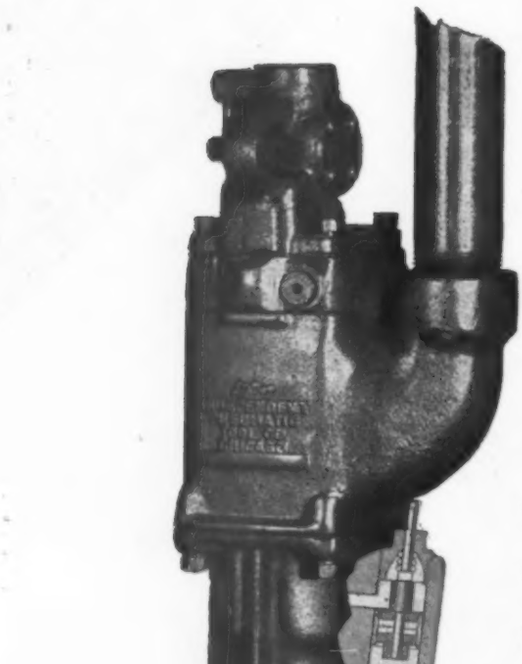

. . . *Improved Lubrication Assures Peak Efficiency*

In Sump Pumps, the *impeller shaft bearings* are the most vulnerable parts, with premature failure causing undue job delay and expense. Thor safeguards these vital points by a large grease reserve that is force-fed under continuous air pressure—pressure that further prevents foreign matter from working into the bearings. Because of this *exclusive feature*, Thor Pumps can be operated continuously up to a full shift without regreasing.

Thor Sump Pumps are designed to operate efficiently in clean or dirty water; in oil, sludge or sewage—either partially or fully submerged. Your nearby Thor Distributor will gladly demonstrate them as the economical answers to your sump-water problems.

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RAILROAD RELOCATION
Rushed with Euclids

On this 200,000 cu. yd. contract for relocating main line road bed of the Nashville, Chattanooga and St. Louis Railway north of Cartersville, Ga., MacDougald Construction Company of Atlanta used 6 Bottom-Dump and 3 Rear-Dump Euclids, and a Euclid Loader. Work was begun in September and completed in November, 1946 under supervision of R. E. Armistead.

About 175,000 cu. yds. of chert containing many boulders were loaded into Bottom-Dumps by the Euclid Loader. Although working in difficult material, Loader production was approximately 395 cu. yds. per hour. Rear-Dump Euclids moved 25,000 cu. yds. of shovel-loaded rock on hauls up to ½ mile long.

Ability of Euclid equipment to "keep coming back for more" was a very important factor in completing this job ahead of schedule. MacDougald has used "Eucs" on big earth moving jobs in many parts of the country and now owns a total of 19 Bottom-Dumps, 6 Rear-Dumps and 2 Euclid Loaders. Repeat orders from leading contractors like MacDougald are owner endorsements of the fact that Euclids move more yards at lower cost.

Your Euclid Distributor or Representative will provide literature and information on models best suited to your needs.

The EUCLID ROAD MACHINERY CO., CLEVELAND 17, OHIO

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(Turbine Oil Oxidation Test)

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No satisfactory, quick, short time oxidation test methods have yet been developed. Sinclair Research does not compromise. Some studies require continuous tests of 1000 hours. Others, performed with the apparatus above, are run for 100 hours or more.

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Sustains top engine performance

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MAXIMUM PERFORMANCE with MINIMUM CREWS

For road and airport paving and for general concrete construction, Blaw-Knox builds machines and equipment requiring only minimum crews to complete a quality construction project in the quickest possible time. *Low cost per yard* tells the story of the contractor's profit.

Look to Blaw-Knox for detailed information and performance data on the time and money saving equipment shown here — and also ask for data on Blaw-Knox Road Forms; Curb and Gutter Forms; Sheepsfoot Rollers; Truck Mixers and Agitators; Truck Turntables; and Steel Forms for General Concrete Construction.

You should have a copy of Bulletin No. 2036. *Send for it.*

BLAW-KNOX DIVISION of Blaw-Knox Company
2003 Farmers Bank Building, Pittsburgh 22, Pa.

See your Nearest Blaw-Knox Distributor.

BLAW-KNOX CONSTRUCTION EQUIPMENT

GEMMER
EASY STEERING IN ALL MODELS OF
FEDERAL TRUCKS Including the 55,000 lb G. V. W.

Federal Trucks, with their excellent reputation for long, dependable service in toughest operations, are 100% equipped with Gemmer Easy Steering —including the 55,000 lb G.V.W. model for heavy duty and off highway work. Gemmer Steering makes these jumbos easy to handle.

Gemmer is the simplest, sturdiest, most compact, most efficient type of steering gear. Steering is always firm, responsive, positive, with absence of rubbery feeling or wander. Abundant power for parking eases the labor of maneuvering. Extremely durable, a Gemmer Steering Gear will last the life of the vehicle with reasonable care.

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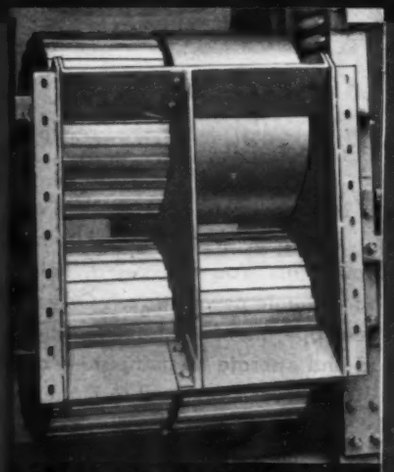
SENSATION OF THE GRAVEL PIT



Feed opening view TwinDual Rolls

Only UNIVERSAL Offers TWINDUAL* ROLLS

Two stages of secondary reduction in one crusher. Doubles normal primary jaw crusher output. Its use in gravel plants is the greatest achievement in a generation. The only really new and different post war plant being offered on the market today.

*PATENTED

No equal for capacity where crushing must be done. In field tests, under identical pit conditions, production is more than double the output of larger, standard conventional plants.

FEATURING

- THREE STAGES OF REDUCTION WITH ONLY TWO CRUSHERS
  FIRST STAGE—JAW CRUSHER
  SECOND AND THIRD STAGES—TWINDUAL* ROLLS
- TOP CAPACITY WITH MINIMUM WEIGHT AND POWER REQUIREMENT
- ROLLER BEARING THROUGHOUT FOR SMOOTH, BALANCED OPERATION
- READY PORTABILITY, QUICK AND EASY SET-UP
- MEETS HIGHWAY REQUIREMENTS

●

WRITE FOR COMPLETE INFORMATION

UNIVERSAL ENGINEERING CORPORATION
631 C Avenue, N. W., Cedar Rapids, Iowa

40 YEARS OF PROGRESSIVE SERVICE TO THE CRUSHING INDUSTRY

KOEHRING HEAVY-DUTY HALF YARD

2-in-1 SHOVEL BOOM Cuts Cost 30% When You Add Backhoe to Shovel

INDEPENDENT TRACTION Steps Up Crane, Clamshell, Shovel Output

Husky 2-in-1 Shovel Boom meets both shovel and backhoe requirements, makes trench dressing easy. Boom does not "weave."

Because the 2-in-1 Shovel Boom is standard equipment on the Koehring 205 shovel, backhoe job profits can be yours with only small additional investment. Same boom serves both attachments. Front end equipment to convert Koehring 205 shovel to backhoe costs approximately 30% less than with machines using conventional backhoe attachment with special boom. You get a huskier shovel boom PLUS a rigid backhoe boom that never weaves. Backhoe dipper never turns away from cut. Backhoe sidecutters can be used to full advantage in widening trench or dressing side of basement excavation. Because 205 does complete job, hand finishing is unnecessary. Low investment cost on backhoe attachment increases profits on both shovel and backhoe work.

Independent travel — travel while you swing, hoist boom or load — makes travel-time productive time with any front end.

Swing and Hoist While You Travel

With the Koehring 205, you don't lose productive time while getting ready or worry about boom clearance when you turn. You can swing, hoist load, or change boom angle as you travel. Or you can carry on all four operations — travel, swing, raise or lower load and operate boom hoist — all at the same time. You never stop work to maneuver the turntable into a precise, hard-to-reach travel or steering position. With the Koehring 205, you steer and travel with turntable in any position. This is a valuable time saver in tight quarters. You can often work as you travel. Because you handle several operations simultaneously, move-up time is no longer unproductive. With any front end, you get more work done every shift.

KOEHRING HEAVY DUTY

KOEHRING COMPANY
Milwaukee 10, Wisconsin

On Koehring 205 shovel, chain-driven double-cable crowd gets extra power to the dipper for tough digging jobs. Low center of gravity, well in back of center of rotation, steps up digging stability.

KOEHRING for hauling and paving

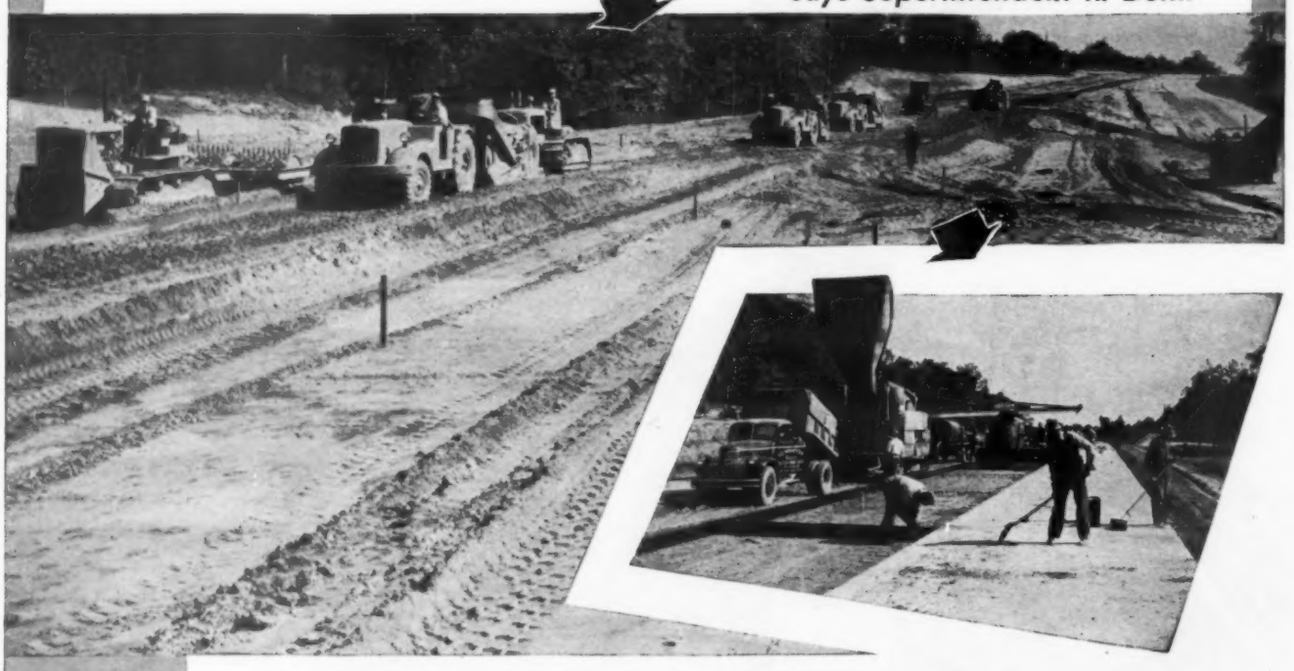
Koehring Dumptor has no body hoist, dumps in 1 second in any weather. Seconds saved add up to extra yardage every day.

Koehring *Cedarapids* paver gets highway jobs through on schedule, in the money. Time-tested, job-tested, Heavy-duty construction.

DETROIT PUBLIC LIBRARY

"Gulf products and fine service help us get an extra margin of performance from our equipment"

says Superintendent R. Dunn



The Bero Engineering and Construction Corporation, Buffalo, N. Y., have the contract to rebuild 5.33 miles of Route No. 60 in James City and New Kent Counties, Va. The project involves over 379,000 yards of excavation, and two 24-foot concrete lanes with a 40-foot grass-plot center.

THIS HIGHWAY PROJECT is one of many earth-moving and paving jobs where Gulf quality lubricants and fuels work as a team to help contractors make faster progress, higher profits!

Here's why so many leading contractors are partial to Gulf products: They have found that Gulf lubricants provide a higher degree of protection for equipment that's pushed to the limit—and that Gulf fuels are of a uniform high quality that insures maximum engine performance. Result: fewer delays, more efficient operation, lower maintenance costs, and jobs finished ahead of schedule.

Write, wire or phone your nearest Gulf office today and arrange to use Gulf higher quality lubricants and fuels on your next job. They are quickly available to you through 1200 warehouses in 30 states from Maine to New Mexico.

GULF

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:
Boston • New York • Philadelphia • Pittsburgh • Atlanta
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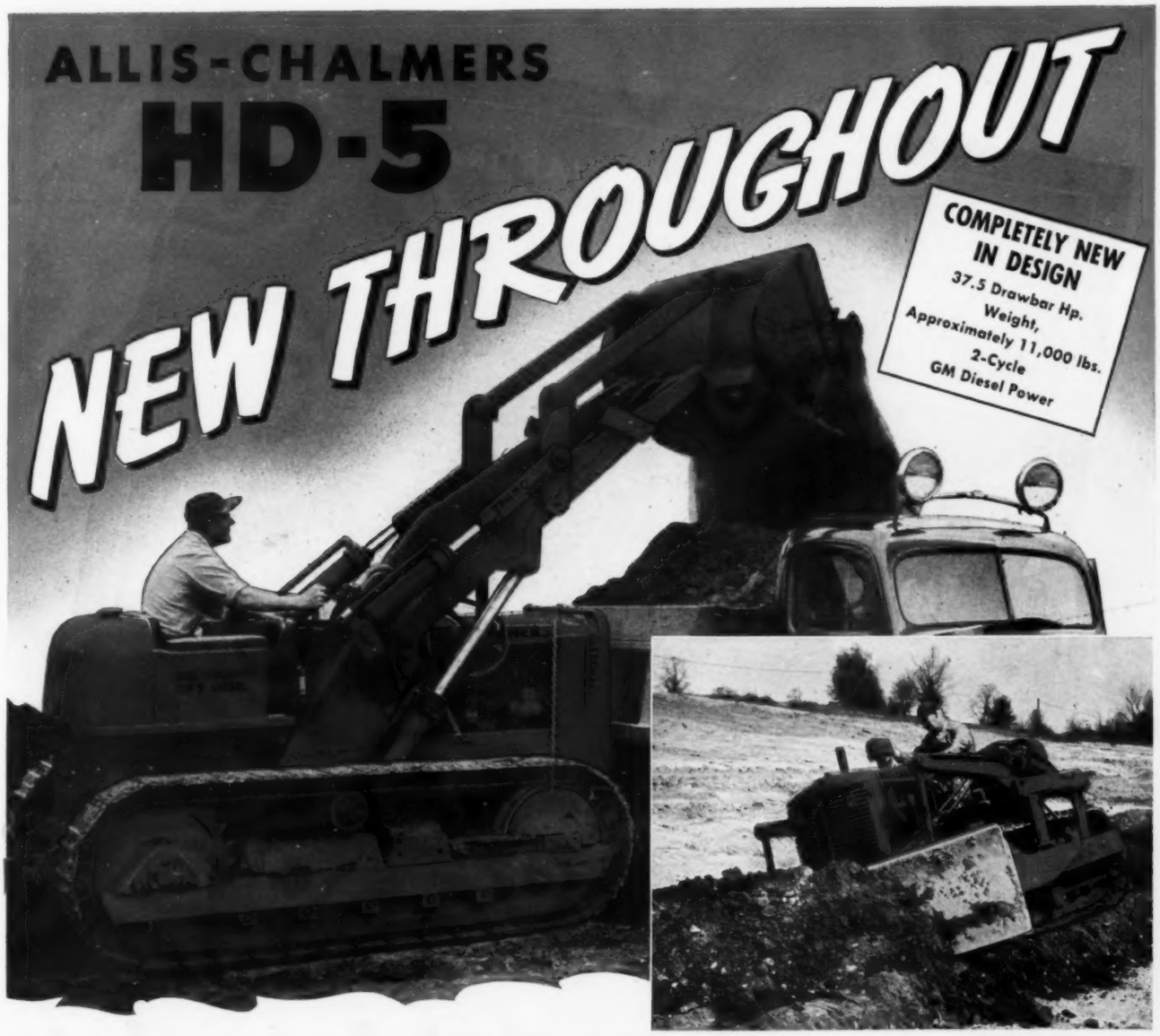


NEW PERFORMANCE...NEW WORK CAPACITY...NEW SIMPLIFIED SERVICING

Instant starting.

Quick pick-up.

Fast maneuvering.

Comfortable operation.

Rugged and dependable.

Increased lugging ability because of built-in characteristics of General Motors 2-Cycle Diesel engine.

More footing and greater traction to handle larger loads under a wider range of conditions.

Tractor weight balanced for most efficient drawbar and front-mounted equipment use.

Tractor construction permits separate and convenient removal of major assemblies.

Greasing intervals lengthened—1,000 hours for truck wheels, front idlers and support rollers.

Lubrication fittings reduced in number and made readily accessible.

Adjustments easily reached and quickly made.

Get the full story of this great, new diesel tractor from your Allis-Chalmers dealer.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

blueprint for safety

We put this safety specification on paper to show you why it works so well in actual practice.

Every detail of FLEX-BEAM Guardrail is designed for utmost safety. No wonder it promotes driver confidence, encourages safer driving, and guards against injury and loss of life.

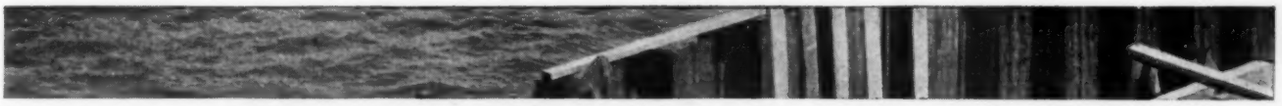
This sturdy rail is made from heavy-gage steel for toughness and resiliency. Extra deep corrugations lend it unsurpassed beam strength while heat-treated bolts assure positive splices. With FLEX-BEAM, all the strength is in the rail. There is no dangerous pocketing, and the continuous sliding surface automatically deflects a striking vehicle and guides it parallel with the road.

Unskilled workmen easily install FLEX-BEAM with ordinary hand tools. No adjustments are needed. No springs, turnbuckles, deadmen or castings. Any type post may be used. No stretching is necessary on curves and the posts stay in perfect alignment. And maintenance is sure to be low because an occasional easy painting job is usually all that's required.

A small investment will prove to you that FLEX-BEAM is the simple, practical way to lessen certain traffic hazards. Write for complete information and ask about FLEX-BEAM Bridge Rail as well. Armco Drainage & Metal Products, Inc., 365 Curtis Street, Middletown, Ohio, Sheffield Steel Corp., Kansas City, Missouri.

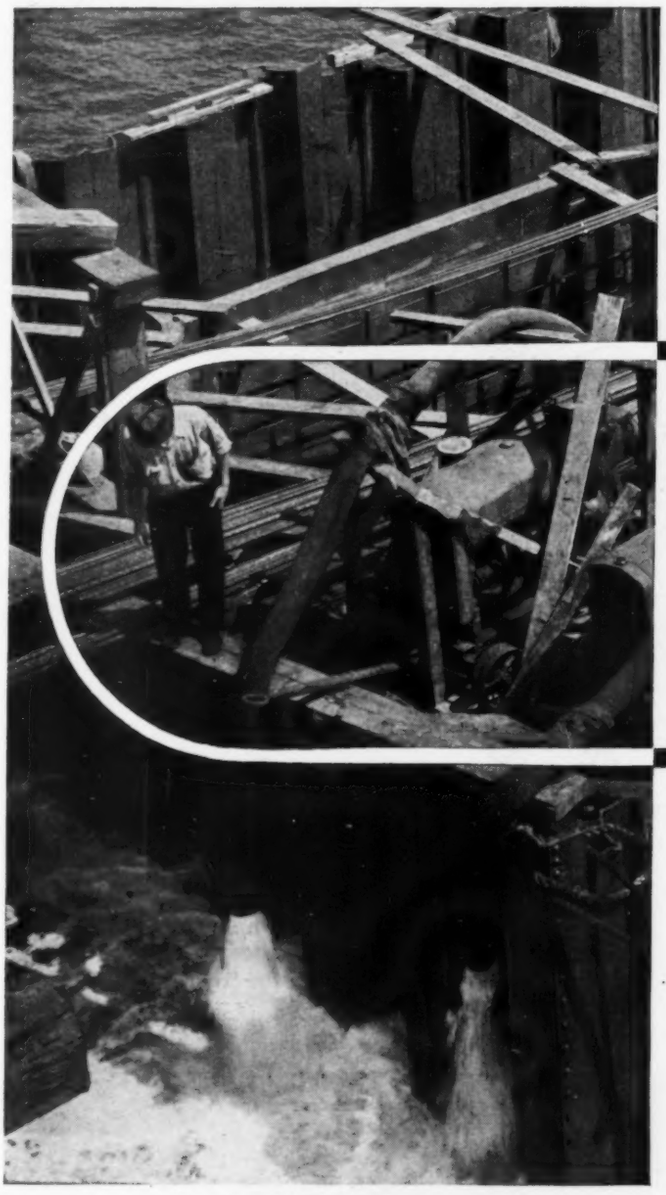
Flex-Beam GUARDRAIL

ARMCO



Contractors pumps can't be

"CHOOSY"



They have to pump more than water – muck, weeds, sand, gravel and other solids. Gorman-Rupp self-priming centrifugals handle anything that comes their way for days, weeks, months at a time, if you want them to. And, they'll stand up. There's not a quitter among them! There's a big reason for this. The insides of a Gorman-Rupp are by far the simplest ever made -- no small openings. No by-pass tubes, no sharp corners, no tricky valves. There's no place for refuse to stick or lodge. All internal passages are genuinely streamlined. Trouble is saved. Capacity stays up. Efficiency goes up. Repairs stay down. Thirty to sixty days without a stop and without harm to the mechanism is common with Gorman-Rupp Pumps. You can handle more water per hour, size for size of pump; more and bigger solids; with less trouble and up-keep; and with less fuel, when you do your pumping jobs with a self-priming Gorman-Rupp. We will place one in your hands and let you be the judge.

CAPACITY IN GALS. PER HOUR
with Pump 15 ft. above water

	TOTAL HEAD (incl. friction)			
MODEL	30 ft.	40 ft.	50 ft.	60 ft.
10-M	9000	7800	6600	4500
20-M	16500	15000	12600	9600
40-M	34500	33900	32700	30600
90-M	76800	73800	69600	63000
125-M	109200	104400	97200	90000

Write for detailed information or contact your nearest distributor.

THE GORMAN-RUPP COMPANY

Gorman-Rupp Pumps — Unsurpassed for Pumping Fast

323 N. Bowman St. **Mansfield, Ohio**

Super Service

ON ALL TYPES OF JOBS!

½ and ¾ Yard EXCAVATORS

5 and 10 TON CRANES

Every UNIT is FULLY CONVERTIBLE

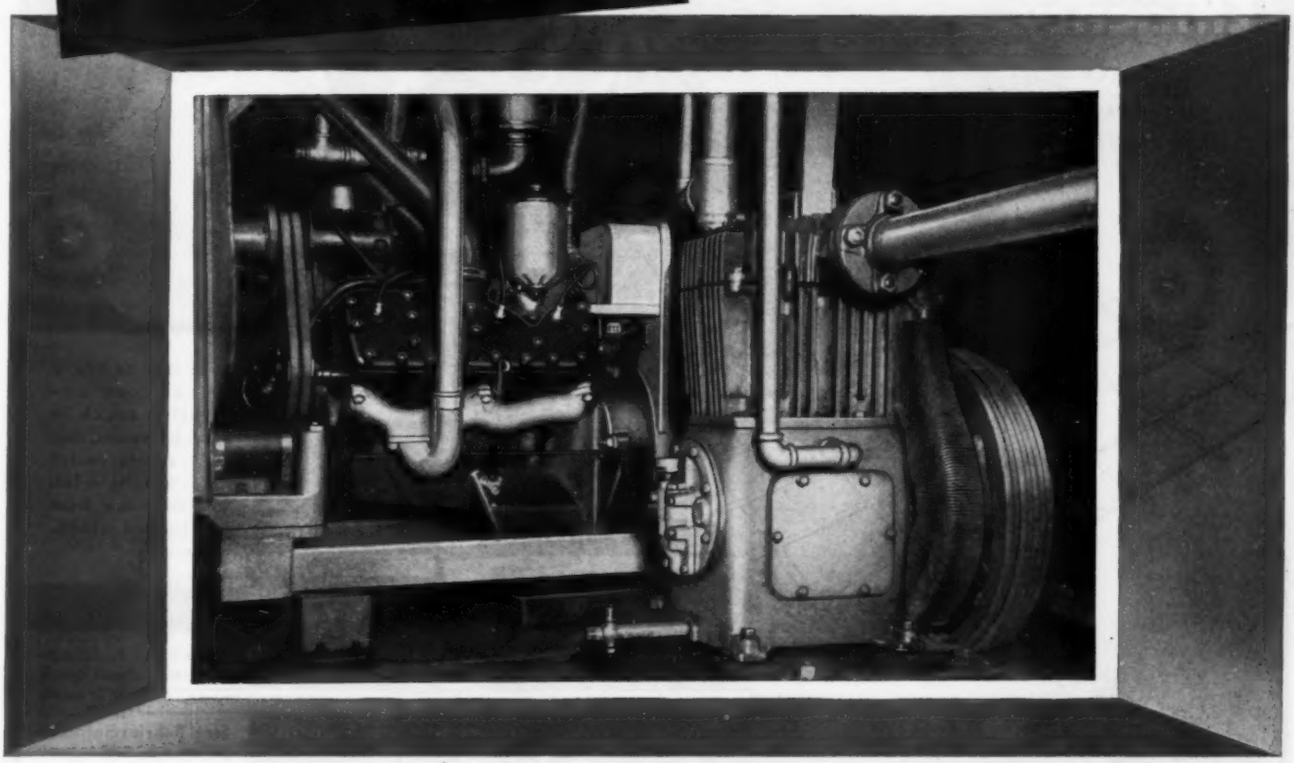
Regardless of whether your job calls for a shovel, clamshell, magnet, dragline, trenchoe, grapple or backfiller, a UNIT machine easily "fills the bill"! For UNIT is convertible to ANY attachment and gives an excellent account of itself on ALL types of service. The change from one attachment to the other can easily and quickly be made on the job, by any ordinary mechanic. UNIT exclusive features include: Automatic traction brakes... Disc type clutches... One-piece cast gear case and above all, UNIT's safety-promoting FULL VISION CAB.

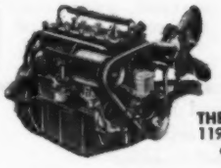
CONTACT FACTORY DIRECT FOR PRICE AND DELIVERY

UNIT CRANE & SHOVEL CORP. 4407 WEST BURNHAM STREET MILWAUKEE 14, WIS., U.S.A.

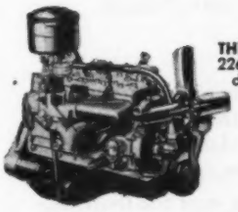
Talk about Performance...

"THIS FORD V-8 ENGINE RAN FOR MORE THAN 6 YEARS BEFORE MAJOR OVERHAUL WAS NECESSARY!"

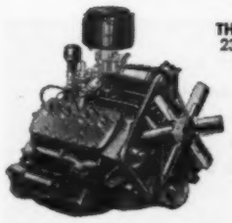




THE 40-H.P. FOUR
119.5 cubic inches displacement



THE 90-H.P. SIX
226 cubic inches displacement



THE 100-H.P. V-8
239 cubic inches displacement

Ford The Hardie Oil Co. of Whitesville, Ky., has been using a Ford V-8 engine since April, 1939, to power an air compressor, developing 350 pounds pressure with a 50,000 cubic foot daily capacity. Dr. J. W. Hardie, company president, says, "This engine operates at 2,000 r.p.m. The oil filter is changed at specified intervals and the equipment is on a regular maintenance schedule. After two years, the engine was disassembled and checked, but as wear was negligible, no repair work was necessary! It was finally overhauled in August, 1945, for $90.00—the only mechanical expense, other than maintenance, since installation!"

Here is evidence of the fine performance of Ford engines! It's proof, too, that proper maintenance means extra-long life. And there's always a Ford Dealer nearby, with trained mechanics, and Genuine Ford Parts to *keep* your Ford engine in the most reliable condition.

For performance, economy and long life, Ford-built engines are preferred! See your local Ford Dealer, or write for detailed data. Address—

FORD MOTOR COMPANY
Industrial and Marine Engine Department
3513 SCHAEFER ROAD • DEARBORN, MICHIGAN

Ford engines are used to power—
Agricultural Machinery • Orchard Equipment • Air Compressors • Road and Construction Machinery • Derricks and Hoists • Electric Generating Plants • Arc Welders • Fire-Fighting Equipment • Industrial Tractors • Lumber and Saw Mill Equipment • Oil Field Equipment • Pumps • Railway Motor Cars • and many other applications.

FORD-BUILT ENGINES

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!

TRUSCON WELDED STEEL FABRIC

Equalizes Load Stress and Helps Maintain High Pavement Efficiency

Plain Pavement
Open Crack
Structural Action at Crack in Plain, Non-Reinforced Pavement
Reinforced Pavement
Closed Crack
Structural Action at Crack in Truscon Welded Steel Fabric-Reinforced Pavement

Note that as heavy wheel load approaches crack in plain pavement, slab end carries entire load weight with no assistance from non-loaded slabs.

As wheel load approaches closed crack in Truscon Welded Steel Fabric reinforced pavement, aggregate interlock renders the crack-joint shear resistant, and *both* slab ends, instead of one, carry the load.

● The tremendous landing impact of giant aircraft is no greater than that to which almost every square foot of your highways is subjected each day. The use of Truscon Welded Steel Fabric for reinforcement is highly desirable. Authoritative and official loading tests prove that cracks in reinforced concrete pavements consistently average a load transfer of about 48% at all seasons of the year. This value represents practically 100% shear-resisting capacity, since a load transfer of 50% is the absolute maximum that could occur theoretically under any conditions.

Cracking in concrete pavements cannot be eliminated entirely, but experience has proved that when the pavement slab is reinforced with Welded Steel Fabric between joints, the formation of wide cracks is prevented. The reinforcing holds the aggregate of the fractured slabs in close contact and enables the slab to function as a unit rather than as individual parts.

You can be sure that Truscon Welded Steel Fabric Reinforcement, and associated Truscon steel roadbuilding products, will build better, lower-cost roads for the communities you serve, and greater prestige for you.

TRUSCON STEEL COMPANY
Reg. U. S. Pat. Off.
YOUNGSTOWN 1, OHIO • Subsidiary of Republic Steel Corporation

Manufacturers of a Complete Line of Welded Steel Fabric . . . Concrete Bars . . . Contraction Joints . . . Dowel Assembly Units . . . Curb Bars . . . Complete Steel Buildings.

Seeing is believing

. . . watch reliable Le-Roi-Cleveland Sinkers at work

—actually see why their surprising speed reduces rock-drilling costs

Even the workmen on the job find it difficult not to watch Le Roi-Cleveland Sinkers go to town. The amazing way these drills eat hungrily into the hardest kind of rock must be seen to be believed.

Speed isn't the only advantage in using Le Roi-Cleveland Sinkers. Drill runners like them — they say these tools are easy to hold. Contractors, mining men, and quarry operators find that this feature enables drill runners to put down more feet of hole per shift with less effort—less fatigue. Here are a few additional design details that mean lower drilling costs for Le Roi-Cleveland users:

Efficient, long-life valve

— the patented Le Roi-Cleveland valve meters the air so effectively that you get more work out of your air compressor. End seating, this valve actually improves with use.

Dynamic, fighting rotation

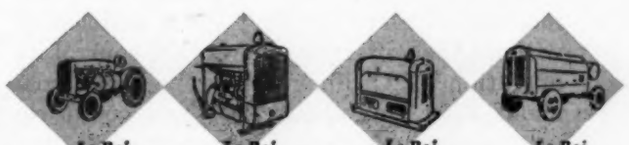
— the sturdy 4-pawl rifle bar and unique arrangement of parts keep the bit turning in the toughest going. Less time is lost because of stuck steel so that over-all drilled footage is considerably greater.

Thorough, positive lubrication

— the highly efficient lubrication system devised for Le Roi-Cleveland Sinkers thoroughly bathes all working parts with a protective coating of oil. Part life is increased many shifts.

Le Roi-Cleveland's line is complete. In addition to the widely used, fast-drilling 45-lb. class H-10 and 55-lb. H-111, there are other sinkers ranging in size from 32 to 83 lbs. Let your Le Roi distributor help you select the right machine for your job.

Write for latest literature. *Reg. U. S. Pat. Off.



*Le Roi 105 Tractair** *Le Roi Heavy-duty engine* *Le Roi Engine-generator set* *Le Roi Airmaster**

LE ROI COMPANY

CLEVELAND DIVISION
Manufacturers of Cleveland Rock Drills
Cleveland 11, Ohio

LE ROI COMPANY, General Offices, Milwaukee 14, Wisconsin

NEW YORK • WASHINGTON • CLEVELAND • MILWAUKEE
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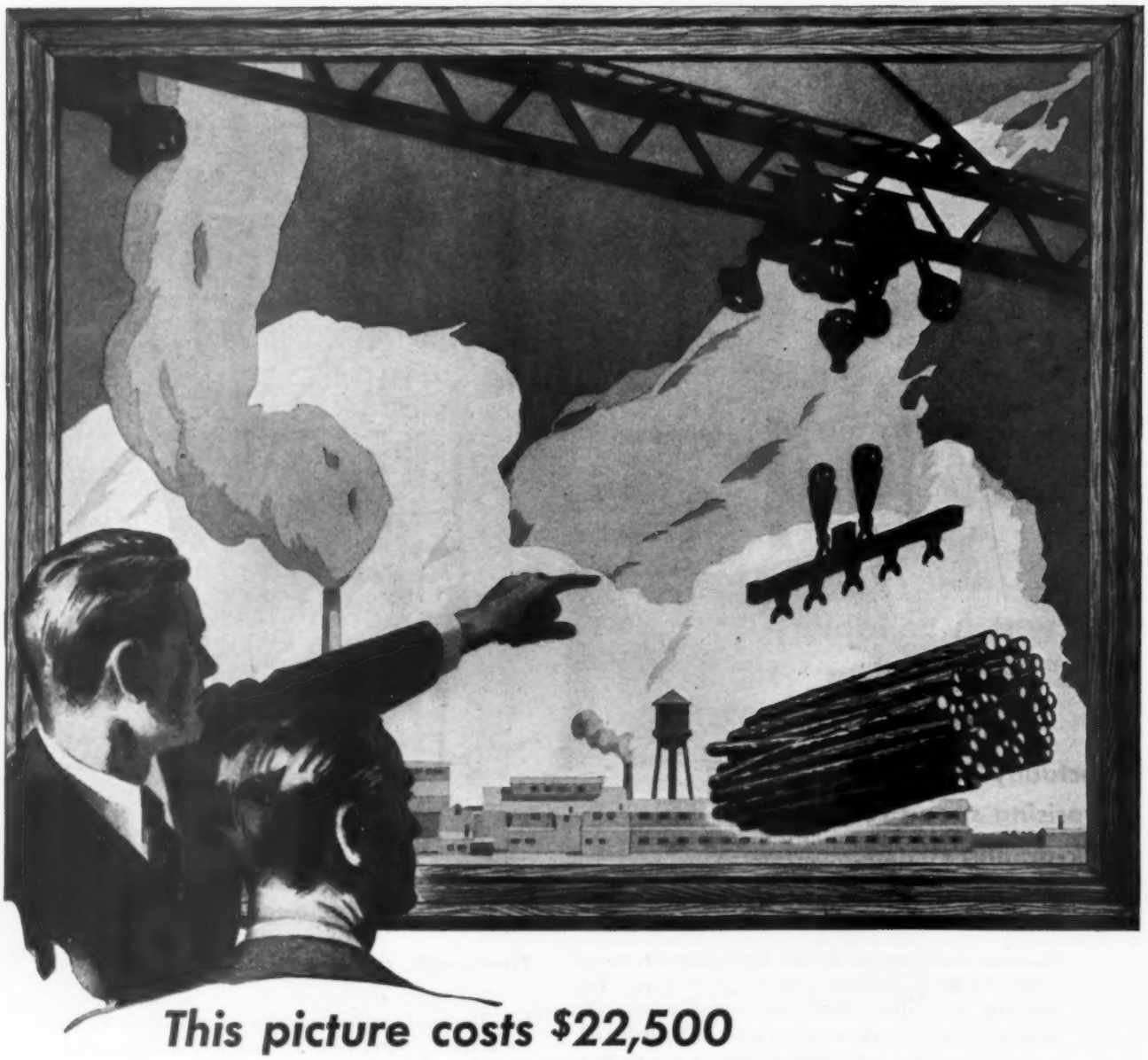
RD-2



This picture costs $22,500 . . . should be $900 more

You may never have to handle pulpwood, but this is a splendid example of where false economy might prove costly.

Actually it's the pulpwood handling crane that costs $22,500—not its picture. But this mechanical giant couldn't lift a matchstick without the wire rope sinews that control its operation . . . Ordinary wire rope would cost about $750. For about $900 you could rig with the *best*—Preformed wire rope made of Improved Plow Steel.

When you buy an important machine make certain it comes equipped with Preformed wire rope. More and more machinery manufacturers are standardizing on Preformed for original equipment because it is the best. It's a money-saver because it lasts longer. Operators want it, because it's safer to handle.

WRITE FOR FREE COPY OF HELPFUL BOOK ABOUT PREFORMED

Address: PREFORMED WIRE ROPE INFORMATION BUREAU • 520 N. MICHIGAN AVENUE • CHICAGO 11

Ask your own wire rope manufacturer or distributor

HANDLES EASIER

PREFORMED WIRE ROPE

LASTS LONGER

The only 3,000- or 4,000-lb. plant that's COMPLETELY PORTABLE

The Cedarapids Model "E" has plenty of capacity for your biggest black-top jobs—up to 4000 lbs. per batch of thoroughly mixed aggregates and bitumen. It can turn out the mix right on the site of the job and then easily and quickly move on to the next job.

Separate, related units with a minimum number of assembly connections and a simple power raising unit make it easy to set up and take down. No shovel or crane necessary. Will handle hot or cold mixes and may be operated by electric, gasoline or diesel power. With a Cedarapids Model "E", you can furnish plant-mix asphaltic aggregates in localities that you formerly had to miss.

When you buy an asphalt plant, buy the best, buy Cedarapids. For accurate batching, high capacity and portability—buy a Model "E". See your nearest Cedarapids dealer for details.

THE IOWA LINE

IOWA MANUFACTURING COMPANY
Cedar Rapids, Iowa, U. S. A.

of Material Handling Equipment Includes: ROCK AND GRAVEL CRUSHERS • BELT CONVEYORS • STEEL BINS • BUCKET ELEVATORS VIBRATOR AND REVOLVING SCREENS • STRAIGHT LINE ROCK AND GRAVEL PLANTS • FEEDERS • TRAPS • PORTABLE POWER CONVEYORS • PORTABLE STONE PLANTS • PORTABLE GRAVEL PLANTS • REDUCTION CRUSHERS • BATCH TYPE ASPHALT PLANTS DRAG SCRAPER TANKS • WASHING PLANTS • TRACTOR-CRUSHER PLANTS • STEEL TRUCKS & TRAILERS • KUBIT IMPACT BREAKERS

INCREASE PRODUCTION with extra-capacity

15 m.p.h. Top Speed

Positive Power Steer

Electric Control

24.00x29 Tires

225 h.p. Diesel

Weighs 20¼ Tons Empty

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See your LeTourneau Distributor NOW for complete information on prices and delivery

on your BIG yardage jobs

"B" TOURNAPULL

CHECK HOURLY YARDAGE PERFORMANCE

Haul — One Way	Sand	Common Earth	Dense Clay
300′	426	379	331
500′	390	347	303
1000′	322	286	250
1500′	274	244	213
2000′	239	213	186
2500′	212	188	164
3000′	190	169	148
3500′	172	153	134
4000′	157	140	122
5000′	145	129	111
10000′	78	69	60

The above production is based on good working conditions, negligible grades, level cuts, efficient management, and a 60-minute per hour operating efficiency.

Tournapull—Trademark Reg. U.S. Pat. Off.—Obin.

LETOURNEAU
PEORIA, ILLINOIS

JOB-PROVED Over 5210 Built and Shipped

TOURNAPULLS

FOR LOWEST NET COST PER YARD

GET TO THE CORE
of Soil Stabilization

If you are ready for the facts about soil stabilization, the facts are ready for you. For it is now possible to accurately predetermine load carrying strength — and to meet specifications exactly. The secret of success can be summed up in one word — *control.*

Accurate control has been the guiding hand in the development of the P & H Single Pass Stabilizer and its applications. It has proved its ability to fulfill these 8 basic requirements under varying conditions—in different parts of the country—*with any type of admixture:*

1. Control processing depth for accurate proportioning.
2. Pulverize the soil thoroughly.
3. Blend materials uniformly.
4. Create a true sub-grade.
5. Disperse the liquid through the entire volume in measured quantity.
6. Mix the coated material uniformly.
7. Lay the completely processed material in a fluffy, even depth, ready for compaction.
8. Do all these things in *one* pass — at a good rate of speed.

During the last half of the 1946 season, *one* P & H Single Pass Stabilizer built 500,000 sq. yds. of Soil-Cement in a Southeastern state.

If the economies of soil stabilization can make your road building dollars go farther, this is the time to get the facts.

P&H

SINGLE PASS
STABILIZERS

4496 West National Avenue
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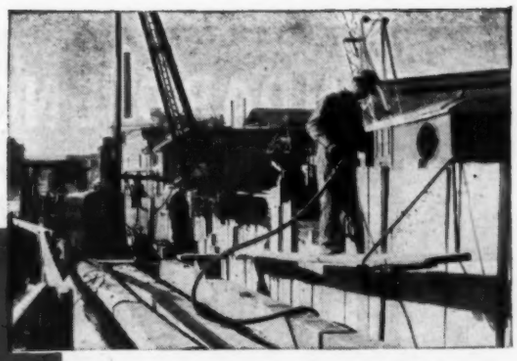
EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS



IF THE JOB IS IMPORTANT . . . THEY SPECIFY SCHRAMM

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ANY TIME

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ANY WHERE

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Here you see 7 construction jobs being furnished compressed air by Schramm Air Compressors. Every one of the jobs is tough . . . but easily handled by Schramm, who furnishes all the air needed.

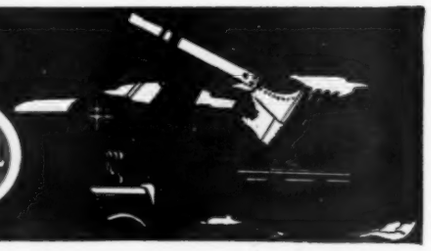
Throughout the country you will find Schramm Compressors used in construction work, specified because they are versatile, compact, lightweight. Schramm offers many advanced features. For full details write us today.

SCHRAMM INC.

THE COMPRESSOR PEOPLE

WEST CHESTER • PENNSYLVANIA

STANDARD ENGINEERS NOTEBOOK



Inhibitor prevents foaming of gear lubricant

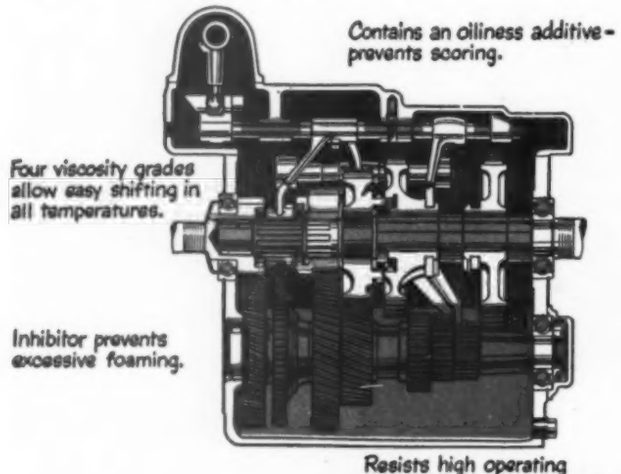
The foaming and expansion of lubricant in transmission and conventional differentials has been eliminated for many operators by the use of RPM Gear Lubricant (Compounded). It contains a highly effective foam inhibitor which prevents retention of air in the lubricant.

Other compounds in RPM Gear Lubricant help it resist high operating temperatures and pressures, dissipate heat rapidly and keep a tough lubricating film on gear teeth at all times.

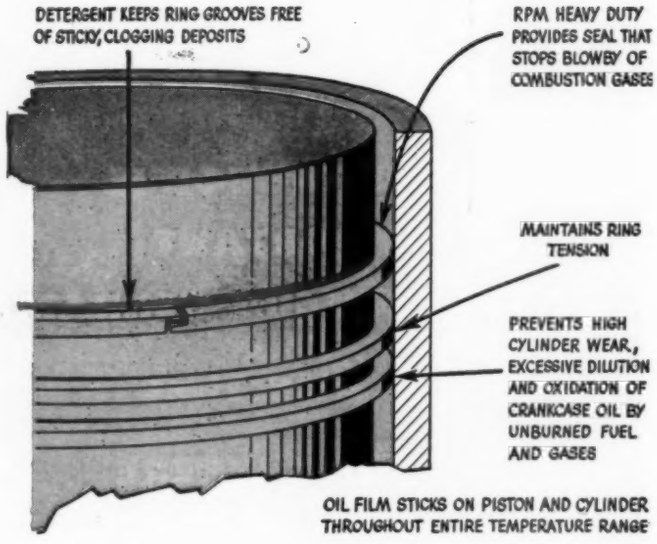
RPM Gear Lubricant (Compounded) will not form deposits in gear cases and is non-corrosive.

It comes in four grades: SAE 80, 90, 140, 250 and is recommended for all automotive transmissions and all differentials (except hypoids) where compounded gear lubricant is specified. (RPM Multi-Service Gear Lubricant should be used in hypoid differentials.)

RPM Gear Lubricant (Compounded) is recommended for most enclosed gears except hypoids.


Contains an oiliness additive - prevents scoring.
Four viscosity grades allow easy shifting in all temperatures.
Inhibitor prevents excessive foaming.
Resists high operating temperatures and pressures.

This drawing prepared with cooperation of Michigan Power Shovel Co.


DETERGENT KEEPS RING GROOVES FREE OF STICKY, CLOGGING DEPOSITS
RPM HEAVY DUTY PROVIDES SEAL THAT STOPS BLOWBY OF COMBUSTION GASES
MAINTAINS RING TENSION
PREVENTS HIGH CYLINDER WEAR, EXCESSIVE DILUTION AND OXIDATION OF CRANKCASE OIL BY UNBURNED FUEL AND GASES
OIL FILM STICKS ON PISTON AND CYLINDER THROUGHOUT ENTIRE TEMPERATURE RANGE

Heavy-duty motor oil reduces cylinder wear

Many operators have eliminated stuck rings, blowby and excessive cylinder wear by using RPM Heavy Duty Motor Oil.

This special heavy duty oil contains patented additives which remove sticky gum, carbon and lacquer from rings and ring grooves, keeping rings free so they can expand fully. With rings expanded, the tough lubricant film of RPM Heavy Duty Motor Oil forms a seal between rings and cylinder which prevents the force of combustion from driving gases and fuels down the walls.

RPM Heavy Duty Motor Oil sticks to metal at all operating temperatures. This assures unsurpassed lubrication at all times on surfaces of cylinders, pistons and rings, reducing wear to a minimum.

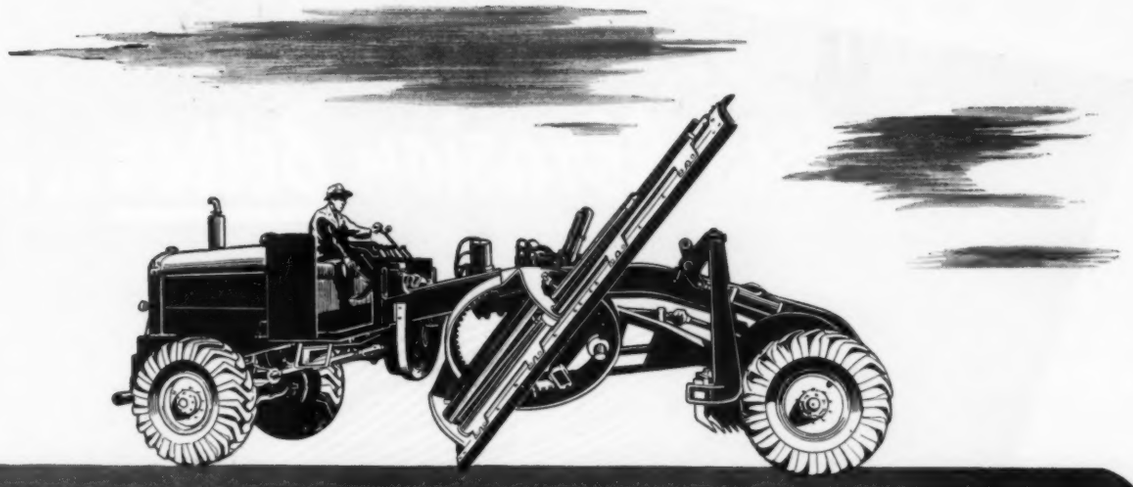
RPM Heavy Duty Motor Oil will resist sludge formation even in coldest operations, will not foam or corrode bearing metals.

Trademarks, "Calol," "RPM," Reg. U. S. Pat. Off.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

All-Wheel Drive and Steer • High Lift Blade • Extreme Reach • Completely Reversible Blade



there is No Substitute

FOR ALL-WHEEL DRIVE AND ALL-WHEEL STEER

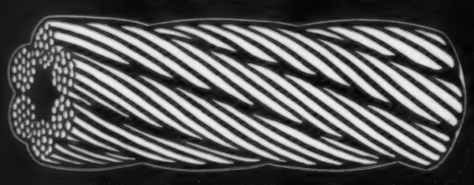
in a motor grader . . . no way in which any rear drive, front steer machine can equal the maneuverability, power-at-the-blade and all-around performance of the 99-H Power Grader.

Get the complete story of the many additional features of the 99-H from your A-W distributor, or send for the latest bulletin.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U. S. A.

Austin Western

Resists Abrasion Better...



UPSON-WALTON LANG LAY ROPE

U-W Lang Lay (in which, unlike other types of wire rope, the wires and strands are twisted in the *same* direction) offers many advantages to many users.

For dragline excavators . . . shovels . . . slope haulages and inclines; for backfillers, slushers, carryall scrapers, and traction ropes on aerial tramways—wherever there are severe abrasion conditions and wherever exceptionally good flexibility and maximum resistance to bending fatigue are necessary, U-W Lang Lay rope can be counted upon to do the best job.

Lang Lay provides the greatest resistance to abrasion because the outer wires have a much greater wearing surface—*almost three times as much as regular lay!* This, in turn, provides greater metallic bearing which reduces wear on sheaves and drums as well as on the rope itself. It should, however, in almost all cases be *Preformed* to prevent untwisting and provide longer service at lower operating cost.

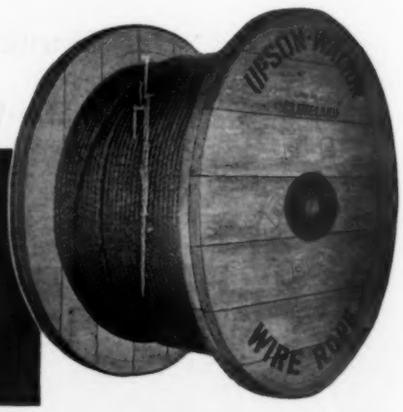
U-W Lang Lay ropes are available with hemp center or IWRC (Independent Wire Rope Center).

For best service where wear is hardest, specify *U-W Lang Lay, Perfection Grade, Layrite Preformed.*

Established 1871

All Upson-Walton Products Available Through Your Local Upson-Walton Distributor

Copyright 1946—The Upson-Walton Company



THE UPSON-WALTON COMPANY

Manufacturers of Wire Rope, Wire Rope Fittings, Tackle Blocks

MAIN OFFICES AND FACTORY: CLEVELAND 13, OHIO

114 Broad Street, New York 4 — 737 W. Van Buren Street, Chicago 7 — 241 Oliver Building, Pittsburgh 22

PERFECTION

Is the answer—

WHEN YOU WANT TO HAUL IN A BIG WAY

PERFECTION has the Body and Hoist combinations that will give you "full rein" --no matter how ambitious your hauling plans may be.

SUPER BODIES

PERFECTION "Series 300" Heavy-Duty Steel Dump Bodies are sturdily constructed of 8 gauge alloy sheet steel for greatest strength. They are especially designed for the most rigorous service--heavily braced at all points of stress--and are of all-welded construction.

SUPER HOISTS

Perfection's remarkably efficient **Iso-Draulic* ROLL-A-LIFT. The upper surfaces of the two lift arms engage two pressure rollers mounted on the body. The design is such that at the beginning of the stroke, where the lift is heaviest, the greatest leverage is provided. The result is tremendous capacity in relation to the piston displacement of this hoist. Two keeper-rollers (patents applied for) travel along the underside of the lift arm flanges, keeping the pressure rollers in constant contact with the arms regardless of body position. Write for complete information.

*Uniform pressure

THE PERFECTION STEEL BODY CO.
GALION, OHIO, U.S.A.

DEMOLITION BLOCKS M-1, M-2, M-3 & M-4

CONTINUOUS SALE

Approximately 23,000,000 pounds
(Sale to Priority Groups closes July 30, 1947)

USES

All of these demolition blocks can be used in place of TNT or 40 to 60% dynamite except in underground operations. An added advantage is that the M-3 and M-4 blocks will give closer contact between the explosive and the object to be blasted. They are ideal for general demolition work, land clearing, excavating, ditching, quarrying, fire control, above ground mining, road construction, stump blasting, seismographic surveying, "blowing" out oil well fires and many other industrial uses. All blocks can be used under water.

★ ★ ★

This is a concurrent and continuous sale, 5% reserved for Federal Agencies and Priority Claimants for a period of 15 days. All orders received from priority claimants will be filled from the reserve. Non-priority orders will be filled as they are received.

This material is offered, as is, subject to inspection by purchaser at location, without expressed or implied warranty except as to title. WAA reserves the right to reject any or all offers, and to make awards in whole or in part. All items subject to prior withdrawal.

Purchasers of Demolition Blocks are required to observe all applicable laws regulating the sale, use, handling and storage of explosive materials.

Purchaser's order must state thereon: (a) "This order is subject to War Assets Administration Standard Conditions of Sale, and all other advertised terms and conditions, and no other terms or conditions should be binding on War Assets Administration", (b) Type of business and level of trade. Orders from veterans must show certification date, case number and location of certifying office.

Demolition blocks are high explosives which detonate with a quick, shattering blast. Their effectiveness is more *than twice that of the average commercial dynamite* and 25% more than that of T.N.T. They are relatively safe to handle and stable to store. They are *less sensitive to shock and friction than dynamite,* and can be burned (in small quantities) without exploding. The four types of demolition blocks are detonated by special electric or non-electric blasting caps or by detonating cord (primacord).

DESCRIPTION AND PACKAGING

M-1 Chain Demolition Blocks consist of eight tetrytol blocks each measuring 2 x 2 x 11 inches and weighing 2½ lbs. The blocks have a tetryl booster pellet in each end and are cast onto a single length of detonating cord. Each block is enclosed in asphalt impregnated paper and the chain is packed in a cloth haversack equipped with carrying strap. Two chains are packed to a wooden box.

M-2 Demolition Blocks are individual blocks identical with M-1 but they have a booster pellet and threaded cap well in each end. The M-2 blocks are packed the same as the M-1.

M-3 Demolition Blocks are 2¼ lb. blocks of moldable plastic explosive of composition C-2 or C-3. Each block is wrapped in glazed paper and inclosed in a cardboard carton. Eight blocks are packed in a cloth haversack; two haversacks in a wooden box.

M-4 Demolition Blocks are ½ lb. blocks of the same composition as the M-3. These are packed 100 to a wooden box.

Prices, F. O. B. location, are as follows:

M-1—75 cents per chain of eight blocks (2½ lbs. each)
M-2—10 cents each per 2½ lb. block
M-3—10 cents each per 2¼ lb. block
M-4—3 cents each per ½ lb. block
Minimum Quantities—1,500 lbs.

This material is available for immediate sale and delivery to all classes of purchasers at the following War Assets Administration Regional Offices in the approximate quantities. Offers to purchase may be made at any WAA Customer Service Center or by letter, wire or personal visit to any of the Regional Offices listed. If your offer is written, mark your envelope "Offer to Purchase Demolition Blocks, A-127".

WAA OFFICE	M-1	M-2	M-3	M-4
Birmingham	525,031 lbs.	430,922 lbs.	—	—
Chicago	716,720 lbs.	44,707 lbs.	—	—
Cincinnati	492,520 lbs.	1,056,250 lbs.	50,965 lbs.	—
Denver	2,731,130 lbs.	143,720 lbs.	643,964 lbs.	—
Grand Prairie	116,560 lbs.	45,772 lbs.	376,679 lbs.	—
Los Angeles	1,682,580 lbs.	870,500 lbs.	474,480 lbs.	—
Minneapolis	1,111,960 lbs.	1,664,320 lbs.	—	—
Nashville	194,440 lbs.	1,189,640 lbs.	804,093 lbs.	—
New York	202,165 lbs.	164,945 lbs.	610,636 lbs.	1,327 lbs.
Omaha	1,335,110 lbs.	278,930 lbs.	316,946 lbs.	—
Philadelphia	352,225 lbs.	384,845 lbs.	—	1,896 lbs.
Portland	592,260 lbs.	877,880 lbs.	—	—
Salt Lake City	676,105 lbs.	1,843,563 lbs.	4,576 lbs.	946 lbs.
San Francisco	3,220 lbs.	17,860 lbs.	27,648 lbs.	—
St. Louis	102,172 lbs.	—	—	—
	10,834,198 lbs.	9,013,804 lbs.	3,312,897 lbs.	4,169 lbs.

OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland Denver • Detroit • Grand Prairie, Tex. • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia Portland, Ore. • Richmond • Salt Lake City • St. Louis • San Antonio • San Francisco • Seattle • Spokane • Tulsa

1276

Shovel Operators Are Talking About...

A revolutionary new power shovel clutch that provides smooth, positive action in place of jerky, uncontrolled performance . . . a clutch that seldom requires adjustment . . . a clutch with only one working part, and without a single cam, lever, bolt, piston or valve.

It's a power shovel clutch with direct air power that assures positive control, without any "grabbing" effect . . . a clutch that needs no mechanical attention . . . a clutch whose simple operation automatically compensates for any wear on the clutch linings.

THE OSGOOD AIR-CUSHION CLUTCH

ANOTHER OSGOOD "FIRST"

POWER SHOVELS • CRANES • DRAGLINES • CLAMSHELLS • BACKHOES • PILE DRIVERS

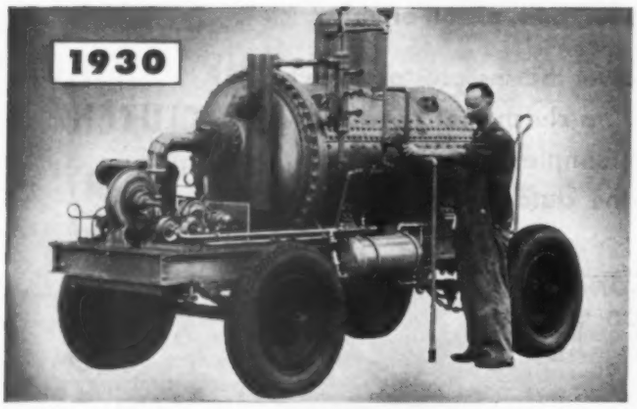
THE OSGOOD CO. O-G THE GENERAL CO.
EXCAVATOR

MARION OHIO

DIESEL, GASOLINE OR ELECTRIC POWERED • ⅜ TO 2½ CU. YD. • CRAWLERS & MOBILCRANES

17 Years at Hard Labor

and still going strong!



Here's the pioneer model of Cleaver-Brooks tank car heaters. Note the compact, well integrated design. Some of these units are still on the job — giving low-cost heat and steam every day!

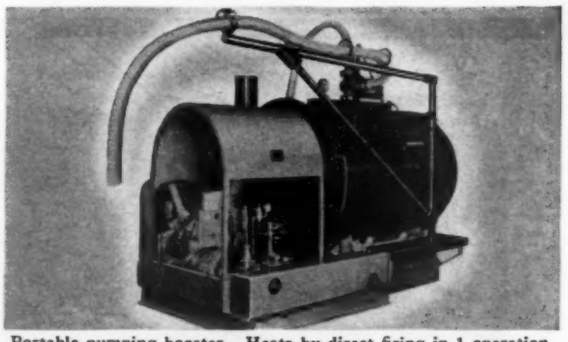
Today's streamline unit, much improved, comes in two and three tank car heating capacities. Dry coil steam condensate return — no water or heat losses — high heat transfer — low-cost fuel.

Most of the Pioneer Models of Cleaver-Brooks Tank-Car Heaters and Boosters built 17 Years ago are still on the job!

A check of service records of hundreds of owners of Cleaver-Brooks tank car heaters and boosters show that units purchased 16 and 17 years ago are still giving economical reliable performance. Right now there are more Cleaver-Brooks tank car heaters and boosters in service than all other makes of similar equipment combined! This equipment is specifically designed to do difficult jobs — the hardest jobs in all kinds of weather and places.

Modern Cleaver-Brooks tank car heaters and boosters, embody many years of experience in use and design. They include every feature that contributes to high efficiency performance and long life. Investigate Cleaver-Brooks bituminous heating equipment. Send for bulletin ...

CLEAVER-BROOKS COMPANY
5100 N. 33rd St., Milwaukee 9, Wisconsin



Portable pumping booster. Heats by direct firing in 1 operation. Loads directly to distributor, relay truck or returns to tank car. Available in 2 sizes for truck or trailer mounting.

A Cleaver-Brooks booster installed on a truck.

Cleaver-Brooks

PIONEERS AND ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM PLANTS

no other paver has a crawler like this!

The MULTIFOOTE *Duomix* a Double Drum 34-E Built by Foote

SHOES are wide—plenty of area in contact with the ground keeps the Duo Mix 34-E Dual Drum MuitiFoote up on top. Treads are close fitting, eliminating the nut-cracker action that picks up stones and trash causing cracked treads.

Alternate lugs on treads permit the ejection of dirt giving a self-cleaning type of action.

Roller shafts are keyed into the side frame, eliminating the U-bolt hanger that weakens the flange.

Smooth idler end rollers eliminate jerky travel action and thereby reduce travel strain on the machine. Back this with simple adjustment and rugged construction and you have a crawler no other paver can equal. It's another one of the reasons why the MultiFoote Duo Mix 34-E Double Drum Paver is the smoothest, fastest Double Drum job on the road, today. Let us send you details.

THE FOOTE CO., INC.
1936 State Street,
Nunda, N. Y.

See Page 107

MULTIFOOTE *Duomix* (DUAL DRUM) 34E

Builders of

ADNUN BLACK TOP PAVERS

MULTIFOOTE CONCRETE PAVERS, AND FOOTE KINETIC MIXERS

Again GM Diesel power pays off

A 3-cylinder series 71 General Motors Diesel was installed in this Northwest pull-shovel which formerly was powered by a gasoline engine. Right off the bat it got one of the toughest jobs on the list—*6 miles of sewer, 8 to 17 feet deep through solid clay and frozen ground.*

It was a good chance to size up what the new engine could do.

It really walked away with the job—finished it well within the schedule—and cut fuel cost from a $7.00 a day average to $1.80.

Even with all its husky horsepower, a GM Diesel is compact enough to fit installations like this. That's because it's 2-cycle with power at every downstroke. It's all work and no play for pistons in this Diesel.

At the same time GM Diesels are simpler in design and easier to service. They make any machine a better machine—sturdy, dependable, economical. So whatever equipment you buy, specify a GM Diesel.

FEATURES OF THE GM DIESEL

QUICK TO START—
on its own fuel

ECONOMICAL—
runs on low cost fuel

EASY TO MAINTAIN—
clean design plus accessibility

COMPACT—
easily installed or moved

SMOOTH IN OPERATION

QUICK ACCELERATION

DETROIT DIESEL ENGINE DIVISION

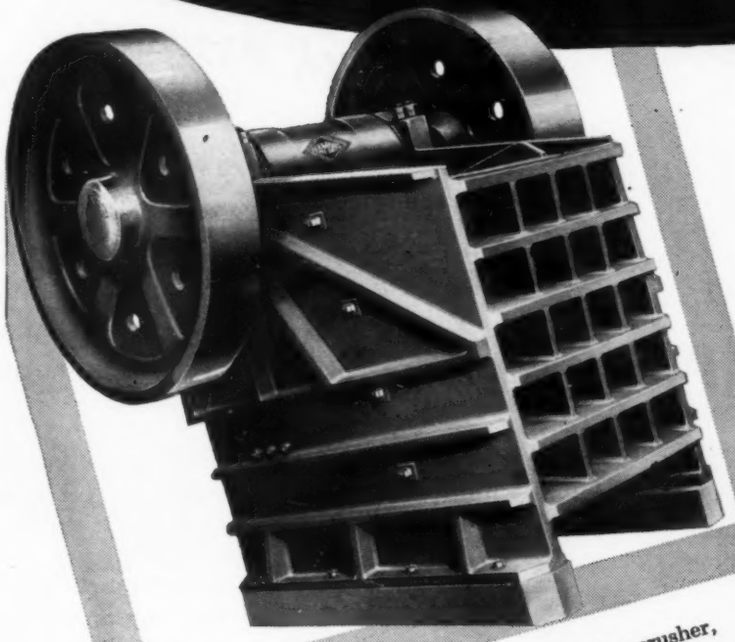
DETROIT 23, MICH. ● { SINGLE ENGINES . . Up to 200 H.P. / MULTIPLE UNITS . . Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

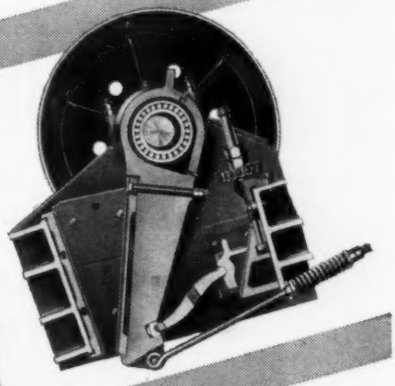
DIESEL BRAWN WITHOUT THE BULK

Maximum PRIMARY OUTPUT



AVAILABLE NOW!
36 x 48
DIAMOND
"LONG JAW" CRUSHER

Real economies are possible with this largest DIAMOND. Capacity up to 500 Tons Per Hour on toughest rock. Minimizes "shooting" costs. Your dealer has complete details.



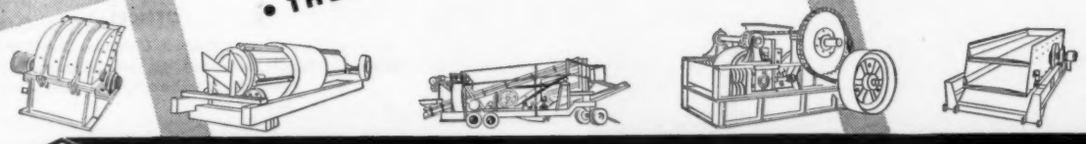
MADE IN TEN SIZES

ASK FOR BULLETIN D45

The triple action of the Diamond jaw crusher, combining a direct dynamic crunch with a relentless downward force feed action, operates from top to bottom of its long jaws. Its heavy overhead eccentric, while closing the jaws for the initial kill, supplies the downward action during the first half-cycle, and, at the up-turn, the secondary low-end crush is delivered by the rising toggle at the bottom of the jaws.

A POSITIVE AND UNIFORM CRUSHING CYCLE

• THERE'S NOTHING TOUGHER THAN A DIAMOND!



DIAMOND IRON WORKS, INC.
AND THE MAHR MANUFACTURING COMPANY DIVISION
MINNEAPOLIS 11, MINNESOTA

The DIAMOND line of Rock and Gravel Crushing and Handling Equipment:

Portable Crushing and Screening Plants	Jaw and Roll Crushers	Scalping Screens
Portable Primary Crushing Plants	Hammermills	Drag Washers
Grizzlies	Conveyors	Feeders
Portable Screening and Washing Plants	Vibrating Screens	Bins—Hoppers

Why is Duraplastic Cement being specified more and more

By

Architects, engineers, contractors, dealers, ready-mix operators and concrete products makers

For

Paving, sidewalks, foundations, floors and walls—plaster, stucco, pump-crete, gunite and slip-form work—concrete block, pipe, drain-tile and other products

?

Here are 5 Quick Answers:

1. Complies with ASTM and Federal Specifications. Provides the proper amount of entrained air needed for satisfactory field performance.

2. No extra cost. Sells at the same price as regular cement. Calls for no additional materials.

3. Better concrete. Makes concrete more workable, more plastic and more uniform.

4. More durable concrete. Fortifies the concrete against freezing and thawing weather. Renders paving concrete highly resistant to scaling action of deicing salts.

5. Makes better concrete block. Reduces breakage, improves appearance, lowers water absorption and generally increases strength.

Send for further information. Write Universal Atlas Cement Company, (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

OFFICES:

Albany, Birmingham, Boston, Chicago, Cleveland, Dayton, Des Moines, Duluth, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.

RS-D-51

ATLAS DURAPLASTIC

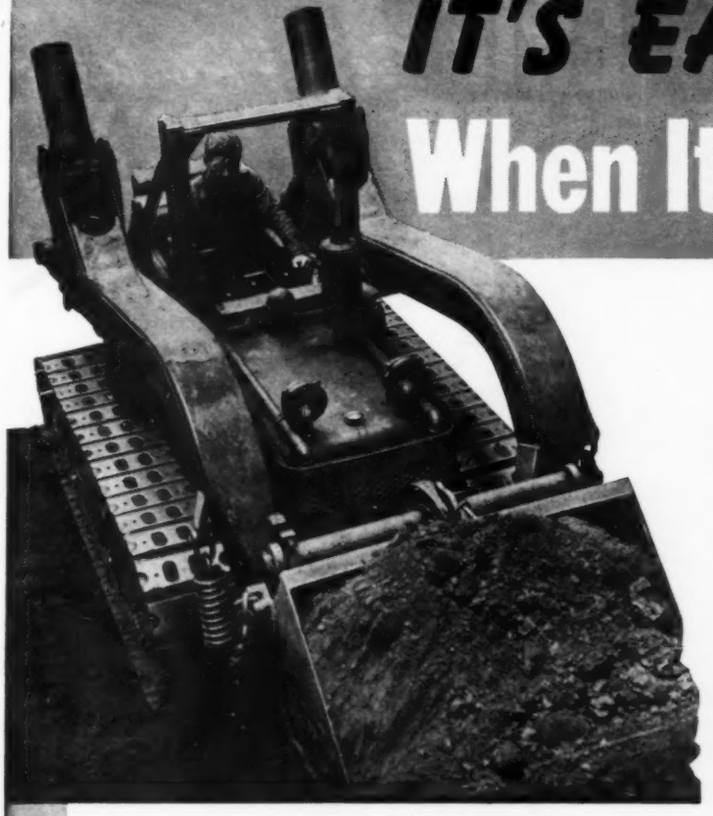
TRADE MARK REG. U. S. PAT. OFF.

AIR-ENTRAINING PORTLAND CEMENT

MAKES BETTER CONCRETE AT NO EXTRA COST

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel—Sunday Evenings—ABC Network*

IT'S EASY TO DIG When It's Easy to See



WHAT a difference it makes in output when you can keep your eyes on everything that's happening in the operating cycle . . . when you can see the bucket as it enters the digging, watch it get a full load . . . when you can spot the bucket just where you want it for accurate dumping to truck or spoil pile . . . when you can watch the ground over which you must move to reach the digging position.

In both shovel and bulldozer operations, the Bucyrus-Erie DOZER-SHOVEL provides visibility that permits the operator to watch, from his normal position and without craning his neck, everything the bucket or blade is doing. There are no frames, winches, hydraulic cylinders or other obstructions to block his full front vision.

Such visibility is one of the many features that have made the DOZER-SHOVEL a tremendous operator-favorite from coast to coast. The net effect of these features — faster, more effective dirt moving — has made it tops with owners too!

Ask your International Industrial Tractor Distributor for more information about Bucyrus-Erie DOZER-SHOVELS for International T-6, TD-6, T-9 and TD-9 tractors. Bucyrus-Erie Co., South Milwaukee, Wis.

70T47

See Your INTERNATIONAL Industrial Tractor Distributor

For BUCYRUS ERIE *Balanced* Tractor Equipment

ERIE *Portable* CEMENT PLANTS

Type "M" 3 Standard Sizes

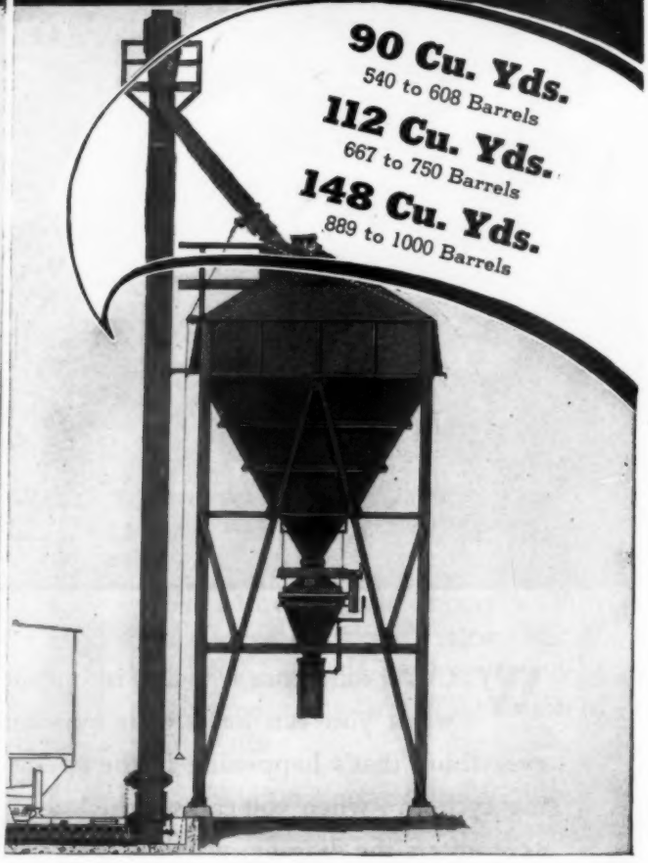
29 Cu. Yds.
172 to 194 Barrels
45 Cu. Yds.
270 to 304 Barrels
73 Cu. Yds.
437 to 492 Barrels

Type "M," a complete single compartment bulk cement storage and batching plant designed for easy portability. Made with 2 or 3 sections. This efficient, low cost plant eliminates all the inconvenience and waste from handling bag cement. A selection of weighing Cemeters provides accurate batching of cement to batch trucks and truck mixers. Write for Bulletin M.

ERIE *Semi-Portable* CEMENT PLANTS

Type "L" 3 Standard Sizes

90 Cu. Yds.
540 to 608 Barrels
112 Cu. Yds.
667 to 750 Barrels
148 Cu. Yds.
889 to 1000 Barrels



Type "L" Cement Plants, semi-portable, knocked down type made in large bolted sections for fast field erection. Available in one or two compartments, each with a choice of 4 weighing Cemeters to provide accurate batching of bulk cement into batch trucks or truck mixers. 30 Ton per hour bucket elevator fed by undertrack screw from hopper bottom cars. Write for Bulletin L.

ERIE STEEL CONSTRUCTION COMPANY

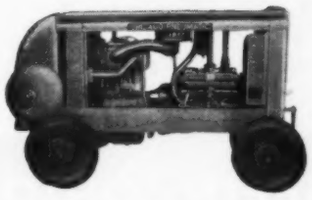
377 GEIST ROAD ERIE, PA., U. S. A.

GENERAL PURPOSE CLAMSHELLS ● PORTABLE CONCRETE PLANTS

One of 10 Erie types of buckets available in 11 standard sizes from ¼ to 2½ Cu. Yard, incorporating the block and tackle plus leverage principles with selective reeving for speed and power. Steel castings and forgings with welded steel plate construction are combined in a low-head design for greatest digging durability. Write for booklet on general purpose buckets.

Erie combines on an 8 rubber tired chassis, a complete concrete making plant. It includes 20 cu. yd., 3 part storage bin, vertical bucket elevator, Weighing Aggre-Meter with extra beam for measuring water. All bin gates are hydraulically operated by fingertip action. Make concrete where you use it. Write for new booklet.

it can be done efficiently with CP construction equipment



You can count on fuel savings of 15% to 35% with a CP Portable Compressor, with its economical engine and gradual speed regulator. Models from 60 to 315 c.f.m., gasoline-driven; from 105 to 500 c.f.m., Diesel-driven.

Four feet a minute through gravel is easy with CP-116 Sheeting Driver.

CP Sump Pump starts instantly; simply turn on the air, lower Sump Pump into water and pumping begins.

One of the many outstanding CP time-savers for contractors is the G-200R lightweight Wagon Drill. With its three roller-bearing, pneumatic-tired wheels, it can be moved with ease and speed, even over rough ground, and it will drill holes at any angle. Designed for one-man operation, and fast drilling with the more powerful CP drifter drills.

The complete line of CP construction equipment includes sinker drills, impact wrenches, backfill tampers, sludge pumps, etc. Your CP representative will gladly give you full information on whatever tools you need for any particular job—or write for Catalog 600.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES

It's On-the-Job Performance that Really Counts

The catalog claims, the salesman's sales talk are quickly proved or disproved "on the job". That's why we ask you to check our statements against the record. Hanson owners and operators everywhere endorse the matter-of-fact statement that "Hanson has the answer to your excavator needs".

Specifications in brief: ⅜ or ½ yd. capacity as a shovel – 4½ or 6½ ton lift as a crane – all welded steel construction – Timken Roller Bearings at vital points – bronze bushings at all other points of wear – chain crowd – full revolving – low center of gravity – special Hanson clutches, easily adjusted and relined without dismantling shafts – extra long crawlers – air controlled steering – heavy duty industrial type gasoline or diesel motors – quickly convertible to: CRANE. DRAGLINE. CLAMSHELL. PILE DRIVER. TRENCH-HOE. SHOVEL.

Write for complete specifications and catalog RS-77.

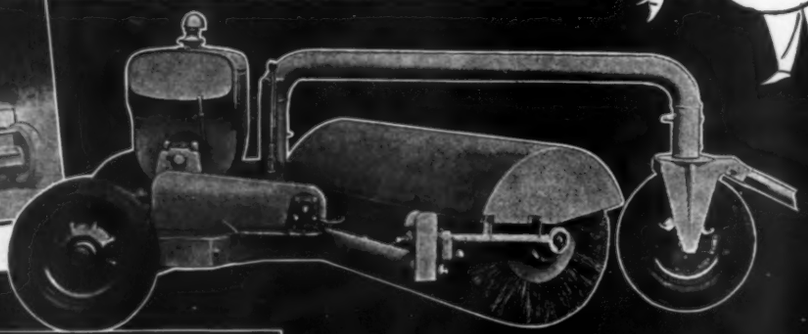
THE **HANSON** CLUTCH AND MACHINERY CO. TIFFIN, OHIO

LITTLE JOE SAYS:

A New Broom Sweeps Clean and LITTLEFORD BROOMS STAY NEW

Before you apply bituminous materials, sweep the surface really clean with Littleford brooms. Power or traction driven, these brooms sweep in either direction; only two minutes needed to make the change. They're sturdy and tough; hydraulic lift raises and lowers brush to regulate tension. These three wheel brooms turn in small radius. Can be equipped with sprinkler system; one can use two-way blower. Get the whole story on Littleford brooms; ask for Bulletin No. 19.

This Traction Driven Broom gets its power from the rear wheels.



BLACK TOP ROAD MAINTENANCE EQUIPMENT LB SINCE 1900

LITTLEFORD LITTLEFORD BROS., Inc.

454 E. PEARL ST., CINCINNATI 2, OHIO

TROJAN

COMBINATION BULLDOZER AND SNOW PLOW

for International Industrial Wheel Type Tractor

When buying equipment a Contractor looks for efficient operation and greater productivity with a minimum cost of upkeep.

A Trojan Bulldozer mounted on an International Industrial Wheel Tractor will exceed all expectations as a tool for backfilling, general cleanup and as a "handyman" around the job. It is well adapted to loose material dozing and can also be used economically as a general drawbar tool for pulling tamping rollers, pulvi-mixers, etc.

Trojan Bulldozers fit the pattern of progressive contracting.

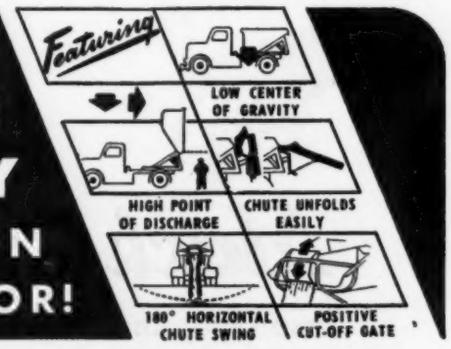
Write for literature or see your International Industrial Distributor.

Contractors Machinery Co., Inc.

Dept. RS-72 Batavia, N. Y.

HERE IT IS!

THE LOW COST CONCRETE (READY MIX) BODY YOU'VE BEEN WAITING FOR!



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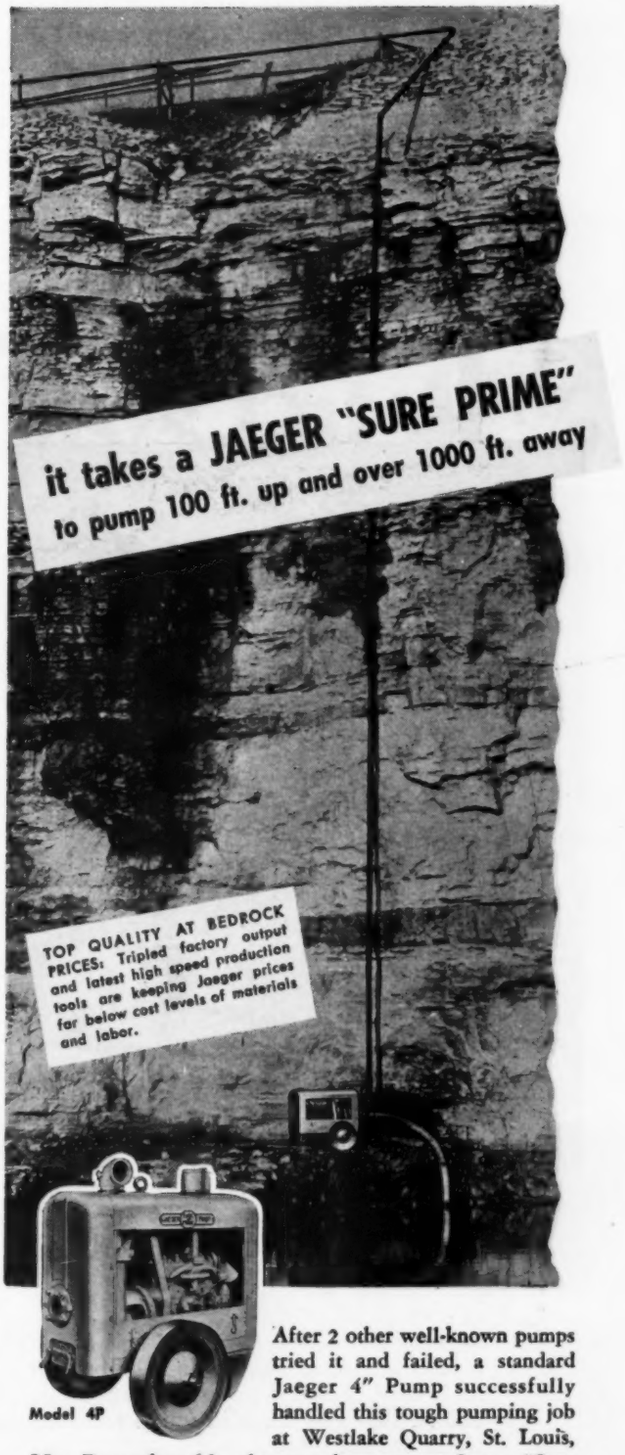
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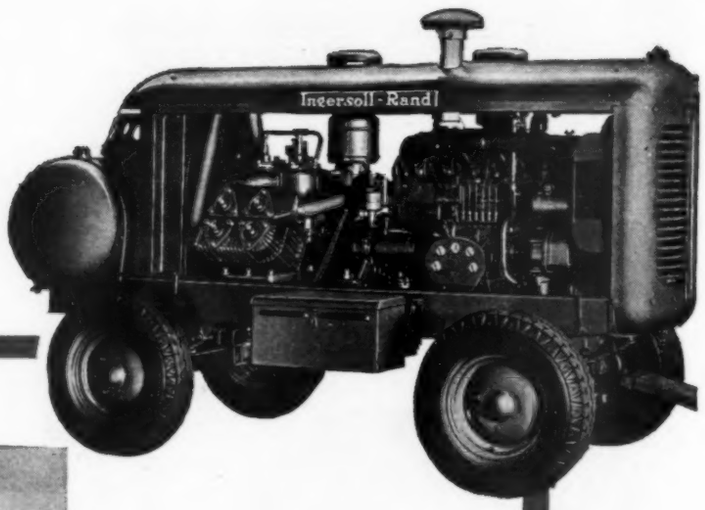

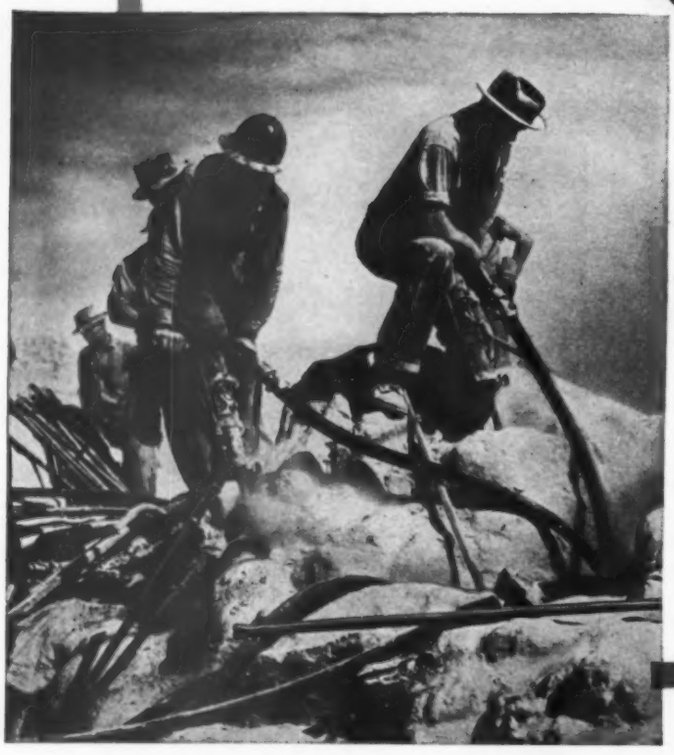

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ROADS AND STREETS

JULY, 1947 • VOL. 90 • No. 7

Joint Sealing Costs Cut 42%

. . . and work of filling longitudinal joints and cracks also speeded up with new methods developed by California highway staff.

By H. L. Cooper

Assistant Maintenance Engineer, California Division of Highways, Sacramento

SEALING of all joints in concrete pavements is generally agreed to be the best insurance, from an economic standpoint, for satisfactory base conditions. A longer service life for concrete pavements will result.

Proper sealing prevents the entrance of pebbles and fine inert material which in time would fill the joints and decrease the designed allowance for expansion of the concrete and result in spalling or even occasional "blowups."

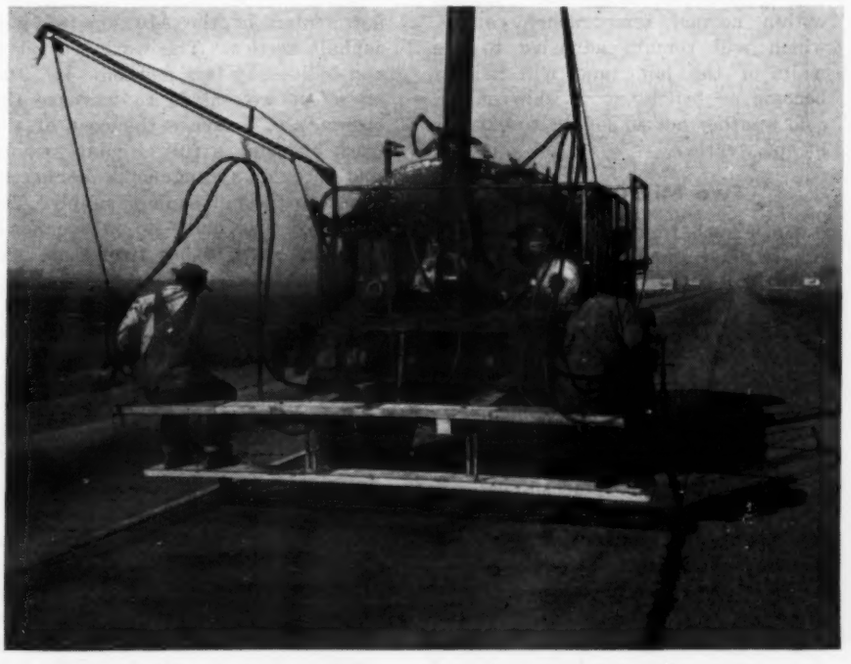
The most serious result of open joints is the tendency for water to collect during rains and penetrate to the subgrade in the joint areas. This applies to joints along the pavement edges, as well as the transverse joints, if both are not properly sealed. This water if allowed to remain starts what is commonly known as "pumping" with subsequent pavement failure.

Importance of Joint Sealing

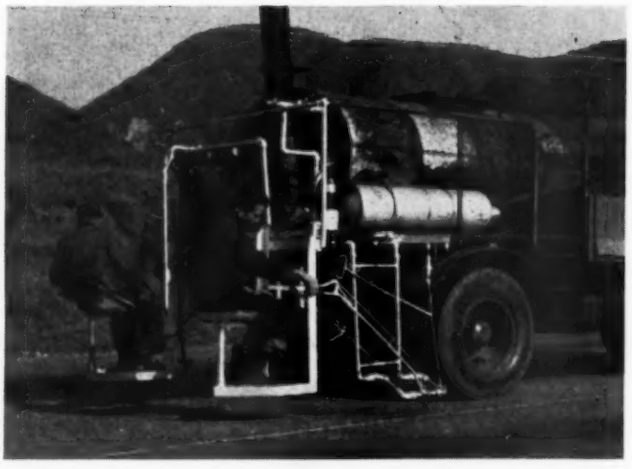
The desirability of using a joint sealing material which will provide for continued satisfactory performance of concrete slabs is important. It has been found that various joint fillers of the asphalt type will not effectively seal joints in concrete pavement under all conditions. Some mixtures become brittle in cold weather and do not adhere to the concrete. In warm weather, some materials may become so soft as to flow onto the shoulders or extrude from the crack and be tracked away by traffic.

Several years ago, an asphalt-latex mixture was used to fill joints on new construction. This material contained rubber and was very effective in sealing joints. It retained its ductility within the temperature ranges required and adhered to the walls of the joint as well. The war stopped the use of this material on account of the rubber shortage and it is only recently that it has become available again.

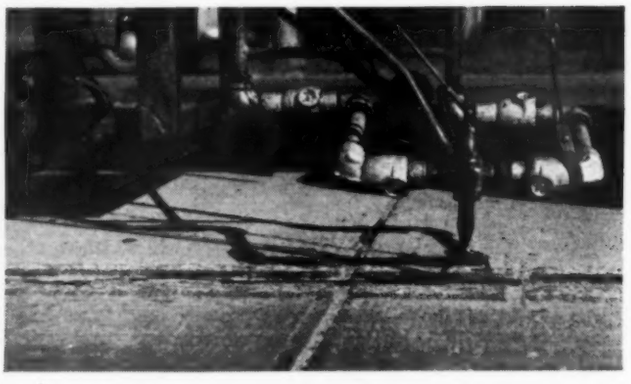
Experiments are now under way by our headquarters laboratory and the maintenance department, using various types and combinations of asphalts and commercial rubber synthetic latex products. These tests



★ Using full circulating metal covered hose and nozzle arrangement on 940-gal. tank assemblies for longitudinal joint sealing



★ (Left): Old type assembly in use at left, new type at right. (Right): Latest improvement of full circulating type assemblies with swivel joints for longitudinal joint sealing



★ (Left): New type of assembly and nozzle used in joint sealing. (Right): New type of assembly using four swivel type Chikson valve. Note two streams of asphalt from nozzle

include use of filler materials to determine the best and most economical materials for use as a joint filler, which will be reasonably ductile within normal temperature ranges, which will remain adhesive to the walls of the joint and will neither become so brittle as to chip out in cold weather nor so soft as to extrude in hot weather.

Two Mixtures Used

Until such time as the ideal product is determined, state maintenance forces are using in general a mixture of 70% 31-40 air-blown asphalt and 30% SC6 liquid asphalt. For some sections of the state, this mixture has been found to be too brittle and a 60-40% mix is more suitable.

Maintenance crews have mixed the two grades in the field in the past with varying degrees of success. In 1946 it was possible for the first time to purchase state specification joint sealing compound in 5-gallon cans, already blended. This procedure has resulted in a more uniform and acceptable filler. In a few cases, it has been arranged to purchase the blended material direct from the refinery delivered to the tank truck at the desired temperatures.

Previous to this year, all joints and crack sealing was done with hand pouring cornucopias, the material being heated in the 110 or 165 gal. asphalt kettles. The work was slow and tedious by this method. In 1946, an effort was made to increase the output and decrease the cost of the work by using a full circulating hose and nozzle arrangement connected direct to the hot asphalt supply. The assembly was made up in the headquarters shop, using two ¾-in. metallic hoses connected to a ⅜-in. nozzle having a long handle, consisting of two sections of pipe and a wheel 10 in. in diameter, mounted ahead of the outlet to carry the weight of the unit.

The nozzle has a quick opening needle valve, operated by means of a ratchet hand throttle from the top of the long handle which permits a steady control of the low flow of asphalt into the joint. This discharge tip has been improved and as now constructed divides the flow into two streams. The smaller stream ahead tends to drive the air out of the joint and the second stream then fills the joint without side splash.

Two of these full circulating assemblies were attached to the rear end of the special 940-gal. heating tank arrangement which had been developed for use on asphalt sub-sealing work. These large units were used in the development work as they were available; however, a 400-gal. asphalt kettle in District VI has been equipped with these nozzles. It appears that use of these kettles instead of the large outfit will be more economical. After a period of trial with the new equipment, it was evident that the metallic hose arrangement was somewhat unwieldy and even presented some hazard to operators of the equipment as the material must be applied at a temperature of from 350 to 400 deg. F., although pressures used are the minimum required for flow of the material. At these temperatures, a burn could result from casual contact with the hose and if a hose should break and an operator be sprayed with the hot asphalt the burn could be a serious one. Fred Bushling, mechanic in the District VII, then designed a full circulating pipe assembly to replace the hose unit. Swivel joints constructed to operate under high temperatures were used in

the assembly to provide for sufficient side movement of the nozzle and allow the operator to follow the joint easily. This assembly is attached to the rear and side of the tank. Whenever work is stopped at the end of the day, a valve is closed at the tank and the pipe assembly disconnected and flushed out with distillate so that it is clean and ready for the new start.

New Equipment

The truck carrying this equipment is operated at a speed of from one and one-half to less than 2 mph. so that the nozzle men can follow along on foot. However, a seat consisting of a plank and later of bucket type metal seats were soon installed for their convenience.

The center longitudinal joint and the joint along the pavement edge can be filled in one operation with a return trip necessary to fill the opposite pavement edge. During the return trip, the second nozzle is used to fill any sections of the center not completely filled on the first trip. An efficient job of joint sealing is obtained with the equipment operating at a speed of from 1.5 to 1.8 mph. The asphalt is poured at a temperature of from 350 to 400 deg. District VII has poured an average of 13½ miles of longitudinal joints per day with a maximum of 19½ miles of longitudinal joints poured in one day.

No improved method has been devised to date to pour the transverse joints and cracks with the above equipment, consequently, all transverse joints are poured by hand with the cornucopias. However, in some cases the work has been expedited by the use of the large heating tank to replenish the supply in the asphalt kettles for the men using the hand pouring pots.

Costs Vary Greatly

The costs of filling joints and cracks in concrete pavement vary greatly. This depends upon the extent of cracking, the time that has elapsed since the joints and cracks were last filled, as well as the amount of asphalt required to properly fill them.

Costs this year for filling joints entirely by hand in three districts average about $67 per mile for a 2-lane pavement.

In order to obtain a definite comparison between costs of filling longitudinal joints in a 2-lane pavement by hand pouring methods as against filling with the large tank and special equipment, costs were kept in two districts. Results showed that filling longitudinal joints only, entirely by hand averaged $14.30 per joint-mile, while the average cost of similar work using the large tank and special equipment was $8.25 per joint-mile, a saving of $6.05 per joint mile or approximately 42%.

Savings Are Expected

As three longitudinal joints are filled on a 2-lane pavement, the savings would amount to about $18 per pavement-mile. The finished joint poured by the special nozzle on the large tank also presents a neater and truer line. Moreover, due to the fact that many more joint miles can be poured by the large tank than by hand, the work can be completed during the cold weather when the joints are open the greatest extent and when other conditions are favorable.

Experiments, as indicated earlier in this article, which have been undertaken at various times to determine the advantages of different materials available for joint sealing lead to the belief that a rubber latex compound gives definite promise of giving satisfactory results. This compound at present is very expensive. Furthermore, special equipment such as a machine to cut out and remove the old fillers to a reasonable depth, as well as a special heat controlled machine for its application, are necessary for its use. It may be, therefore, that the use of the latex compound will be too expensive for a time, except possibly on the more important routes.

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A.E.D. Moves Executive Office to Chicago

C. F. Winchester Resigns;
F. G. Knight Appointed AED Sec'y

The Associated Equipment Distributors board of directors, following their recent Chicago meeting, announced removal of the AED executive office to Chicago; resignation of Carol F. Winchester as executive secretary, and appointment of Frank G. Knight as his successor, according to President William A. Danner of Boston.

Harris & Ewing photo
★ Frank G. Knight

Removal to Chicago by this national trade association of the construction equipment industry was decided by unanimous vote, President Danner stated. Chicago was selected because of its central location and accessibility to all areas. Before World War II the AED office was located in Cincinnati and Milwaukee.

A committee composed of James W. Bell, chairman, Cedar Rapids; G. F. Lowe, Chicago; George E. Hillsman, Chicago; R. S. Patten, Chicago, and Morton R. Hunter, Milwaukee, has been appointed to make arrangements in connection with the change. The move is planned not later than Nov. 1.

Carol Winchester, executive secretary of AED for the past 6½ years, submitted his resignation, effective Sept. 30. He plans to remain in the construction machinery industry by being actively engaged in the exporting of equipment in his own business located in Washington, D. C.

Frank G. Knight, the new secretary, was assistant secretary of AED for the past 3½ years. Prior to joining the AED executive staff in 1944 he served 22 months in the War Production Board as chief, Federal Requirements Section. Mr. Knight's background also includes 8 years as manager of a casualty and fire insurance agency and as a special assistant in the office of the managing editor of the Washington, D. C., Evening Star. In his work for the Star, Mr. Knight did reporting, editorial research, and public relations work in traffic safety, health and better community campaigns sponsored by that paper. He was also active in the Junior Chamber of Commerce and assisted in community chest drives by making radio talks.

Mr. Knight has a degree in law from National University Law School. His pre-legal work at George Washington University included subjects in business administration and engineering.

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The Pennsylvania Highway Department has purchased 10,000 gallons of reflectorizing paint for use on the center lines of U.S. 22 and U.S. 30, major east-west highways. The department has used this type of paint previously but not on such an extensive scale. Formerly the reflectorized paint has been used primarily at bridge and subway approaches and some other dangerous spots.

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DRAGLINE
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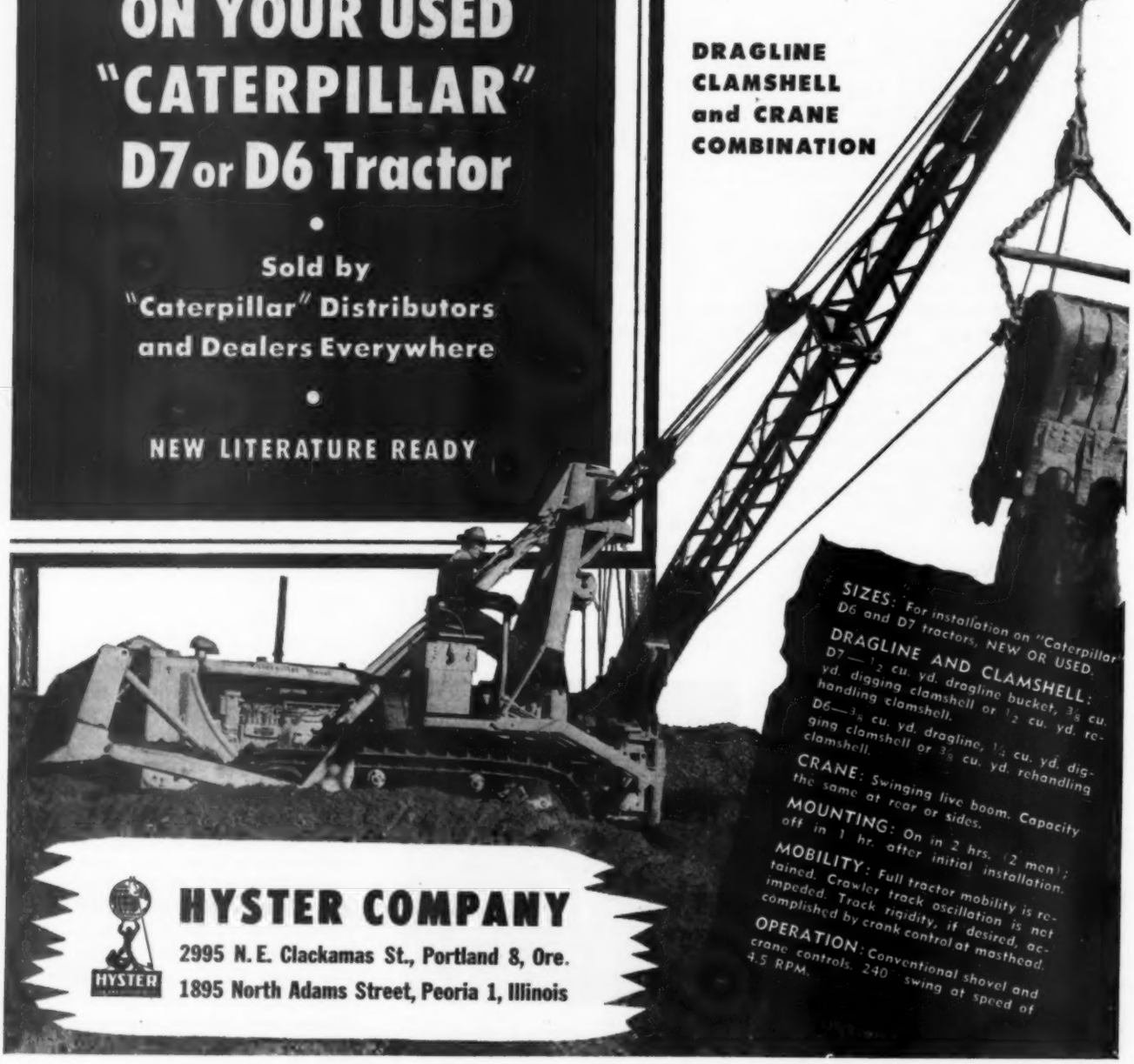
COMBINATION



SIZES: For installation on "Caterpillar" D6 and D7 tractors, NEW OR USED.

DRAGLINE AND CLAMSHELL: D7—1/2 cu. yd. dragline bucket, 3/8 cu. yd. digging clamshell or 1/2 cu. yd. rehandling clamshell.
D6—3/4 cu. yd. dragline, 1/2 cu. yd. digging clamshell or 3/8 cu. yd. rehandling clamshell.

CRANE: Swinging live boom. Capacity the same at rear or sides.

MOUNTING: On in 2 hrs. (2 men); off in 1 hr. after initial installation.

MOBILITY: Full tractor mobility is retained. Crawler track oscillation is not impeded. Track rigidity, if desired, accomplished by crank control at masthead.

OPERATION: Conventional shovel and crane controls. 240° swing at speed of 4.5 RPM.

HYSTER

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AED Rental Schedules Off Press

The AED's fourth edition of "Compilation of Rental Rates for Construction Equipment" is off the press, according to an announcement issued by the Association's executive office in Washington.

In a statement released with the announcement, Eldon M. Farnum, chairman of AED's rental committee, said: "This schedule is published by the Associated Equipment Distributors for the information and convenience of equipment distributors and others who may have need for such information.

"The need for such a rental schedule has been recognized throughout the industry for many years and will prove to be of immeasurable benefit, not only to distributors, but to contractors and others engaged in construction work.

"It should be emphasized that this schedule is being published for informational purposes only and not to suggest or to influence the rates or terms of rental of any item of equipment, as this is a matter which must be determined by the lessee and the lessor of the equipment involved.

"This schedule will be revised or supplemented from time to time on the basis of representative samplings made among various distributors in different parts of the United States, in order to reflect changes in rental rates and terms that have taken place."

Copies are obtainable from the AED executive office, 1928 Eye St., N. W., Washington, D. C., at $3 each; checks accompany order.

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President Signs F. A. Extension Bill

President Truman has signed the so-called federal-aid extension bill (H. R. 1874). The Act (now Public Law No. 100), provides for an extension of one year in the time for availability of federal-aid funds by amending Section 4(d) of the Federal-Aid Highway Act of 1944.

This law will save about $65,000,000 of unobligated federal-aid funds from lapsing on the previous deadline of June 30, 1947, now available until June 30, 1948.

As of April 30, 1947, a total of $462,325,147 of federal-aid highway projects were under construction; contracts awarded but not started amounted to $90,202,189; plans approved but not under contract, $162,500,086; and programmed only, $664,332,494. Federal-aid highway projects now under construction are divided as follows: Federal-aid system, $267,918,946; Federal-aid secondary, $127,115,110; and urban, $67,291,091.

From all reports the highway construction program is gaining ground as various shortages disappear and the 1946 program was about double that of 1945. It appears that 1947 should nearly double that of 1946.

Special Editorial

★ War Surplus vs. New Models vs. Job Profits

A FEW months ago construction equipment people were all in a lather over the return of war surplus machinery from overseas stores. The stuff that has since slipped back into this country, before the unregulated flow of such goods was checked, has indeed caused financial headaches here and there in the trade. It hasn't been fair to the distributors and manufacturers involved.

But our own personal excitement has shifted. Now in the spotlight is the parade of postwar models that has begun to march off the assembly lines.

New model tractors, with refinements that mean better performance and job efficiency.

New and better scrapers, with advancements in bowl design, weight distribution, control, sturdy construction, etc., that make for greater yardage.

Self-powered earth moving rigs—bigger and faster units that will lap the old-timers.

Bigger and faster dump trucks and trailers.

And now comes the new rubber tired dozer—15 mph. forward and backward, continuous flow of power through the transmission during gear changes, 30% more daily yardage claimed.

In the offing are many more innovations—these are just a few. You'll be using vibratory rollers, for example.

We are indebted to the La Plant-Choate people for putting this war equipment vs. new models in its proper light. In a letter to the trade this firm has voiced a fact that, while specifically applying to their equipment line, can also be kept in mind quite generally over the whole equipment front. This fact is that, today—only two years after the war—much war-built construction machinery is likely to be found obsolete.

Because of low price tags, this stuff may seem like "bargain" equipment. But it "ain't necessarily." The only real bargain, today as ever, is the machine that's the most efficient and productive money can buy.

From here on, watch contractors race to house-clean their outfits and take advantage of new equipment with its convincing production data.

From here on, however, *watch out* for the lag in re-tooling that will occur in many county and state highway departments and municipal organizations. These fellows don't have the profit motive to spur them on, and sometimes even indirect incentive is lacking to do a better, faster, cheaper job. Worst picture is seen in some cities, where vintage trucks and other rusty old wrecks are still rolling, and where unit costs are buried under a mass of politics.

As to war surplus equipment—*Caveat Emptor!* (let the buyer beware!).

EDITORIAL

★ Contracting Always a Gamble

Anyone who for a minute forgets that road contracting is a risky and gamblesome business needs only to look at the weather charts for late spring 1947. While grading and paving went rip-snortin' in the West (in the Texas panhandle Austin Road Co. has laid 7-8 thousand feet a day of concrete widening) contractors in the East and Middle West just sat around and muttered. Ohio and Indiana: 45 days of rain in April and May. Pennsylvania: only 4.5 miles of pavement laid in May, despite 183 active road contracts. Iowa and Missouri: floods and wet, wet subgrades.

It all averages up, of course. But some of our contractor friends are going to have to roll from here on, and here's luck.

The contractor who sets up a big outfit on a job with the expectation of getting succeeding contracts or extensions is taking a gamble for sure. Look at what happened at the San Francisco airport. Contractor combine A and B gets a big yardage initial contract, opens up a huge pit, moves in 6-yd. shovels, invests a quarter million in a private haul road, and puts another half million in special 20- and 30-yd. hauling rigs. Up comes a 5-million yard extension contract on the airfield, and presto! Contractor C walks in and underbids. To be sure, the pit and haul road were stipulated to be available for a certain consideration. But the A-B boys were apparently taken off-guard. As balm, however, they sold C most of their hauling outfit. And most likely they came out OK on the whole deal.

★ Bearing or Density?

Time for me to blow my top again!

I attended the regional soil compaction conference of the American Road Builders' Association committee on the subject, at Buffalo, N. Y., the last week of May.

Considerable discussion was given to specifications and job control. If 90% of Proctor density was specified as a satisfactory control and a field test indicated that 89% of Proctor was obtained, the question was raised as to what should be done. That, of course, involved a discussion of the prevalent practice of telling a contractor in the specifications what weight roller he should use, how many passes he should make and what result he must obtain. Silly, isn't it? These specs tell a contractor exactly how the buyer wants the job done, procedure-wise, and then holds him to account besides if buyer doesn't get the *result* he also specifies.

Incidentally, during the discussion it was stated that Proctor densities and procedures are used to a greater extent than the modified AASHO procedures. It was brought out that the making of density tests was slow and not enough were made. "But," said the speaker, "what else can we do?" The speaker knew it was inadvisable to hold up construction and compaction procedures until the results of tests were available.

Replying to this remark, I got up and asked, "What's wrong with using a plate bearing test?" (I never thought about Keith Boyd's cone test, developed while he was with the North Dakota highway department, or I would have suggested it also.) The plate bearing test procedure was thrown out pronto when the speaker said it would take the rest of the afternoon to tell why this procedure was unsatisfactory.

I was not satisfied with reply and rose again to suggest that in soil compaction for highway fills there are, as a general rule, only two factors in which the engineer is interested, and they are: (1) How much of a load will the compacted soil support, and (2) volume change. A plate bearing test, of which the California Bearing Ratio is a good example, certainly should give an answer to how much compaction is required to get a required soil supporting valve.

I gathered from the discussion that soils engineers at that meeting were talking more about density for density's sake without regard to what density would give what supporting value. In fairness to the speaker it should be stated that he quickly qualified his reply to my question by stating that the plate bearing method was being studied by some agencies and that he would have to leave the question answered that way for the time being. What would these soils engineers endeavor to do? Are they compacting for density's sake or would they compact to obtain a soil supporting value that could be depended upon by the design engineer who needs to know this value in designing his pavement thickness? It occurred to me that the viewpoint of the discussions was too narrow.

Don't get me wrong—the meeting was a good one. It was handled excellently—always interesting; but the thinking was not, in my opinion, headed toward the right goal.

For a logical, though empirical, soil substructure construction and control procedure, I refer you to my article, June, 1946, issue of ROADS AND STREETS entitled "Elastic Limit Basis for Finding Soil Bearing Power."

How long will soils engineers play around with density, and I might add, also, the light Proctor procedure, before they realize that sooner or later they'll have to employ a plate bearing (or its equivalent, a shear) test for compaction control? The CBR procedure has proven quite dependable.

—V. J. Brown
Director—Caminos y Calles

★ Short Ones

Funny how state highway departments get stubborn over little details. The contractor who is paving the U.S. 40 reconstruction east of Richmond, Ind., also has an Ohio contract on eastward from the state line. The day we passed by, his 24-ft. finishing equipment had come to the line and he was busy getting going with 12-ft. equipment on the Ohio side.

Why didn't one state or the other yield from its customary procedure in this one instance, so the contractor could effect economies?

•

When a toll road commission is created and proceeds to build a big intercity project on a new line, what happens to the old parallel roads? We're thinking particularly of the Oklahoma case, where the legislature, promoted by oil companies, 'tis said, has fathered a 105-mile toll turnpike between Oklahoma City and Tulsa. The old U.S. 66 is largely obsolete—dangerously narrow and full of "turnover" turns circa 1920-25.

The traffic load on the old road would be lightened, but it'll still need state maintenance. And still constitute a death strip unless large sections are rebuilt or abandoned and closed. Relegating the old road to a secondary status won't end the danger; farmers drive fast, too, as reminded by PRA in insisting on high design standards for F.A. secondary projects.

•

When a rural intersection stop sign is repeatedly shot through by motorists, it means only one thing to us: a bigger or better located sign is needed. Or a light or a special warning sign of some kind. We saw such an intersection the other night, with a state police car parked on the side road waiting to c h a s e after the next offender.

Vindictive speed-trap tactics won't prevent accidents at locations needing better engineering attention.

★ More Airports, More Flying

The postwar boom in private flying was painted during the war as a wonderful mushrooming that would put a plane in every suburban garage. Private air parks would dot the big metropolitan areas, and a hundred thousand planes blacken the skies.

Well, postwar aviation hasn't come along quite as fast as that. And there are those who think we ought to wind up with airfield development for now, or at least slow down from the $500,000,000 3-year CAA program passed last year.

It seems horse sense to foresee that private flying, in fact all aviation, will advance only as fast as we provide fields. It cannot get far ahead of ground facilities. A bulletin from the Airport Division of ARBA discusses this subject in a clear and timely way. We quote herewith:

"From time-to-time, the question is posed as to whether airports are to come *before* or *after* the airplanes. This is similar to the old poser concerning which came first, the hen or the egg. By taking a leaf from the history of automobiles, it can be shown very definitely that the automobile was born of the highways rather than that the roads are offsprings of the automobiles.

"It has been pointed out that immediately before the Federal-aid Road Act in 1916, there were fewer than 2,400,000 cars in the entire country. That was more than twenty years after the automobile was perfected,—yet only slightly more than 2,000,000 automobiles were on the all-too-few highways of those days! What happened after the Federal-aid Road Act became law, and the states assumed their share of the cost of constructing highways? Why, automobiles became rapidly more plentiful, and in only four years' time, after modern highway building got under way in earnest in the United States, automobile registration increased by nearly 200% in those four short years, to 6,800,000 cars.

"It follows," continues this analysis, "that if the aviation industry is to get going in the way it deserves and if the country is to be assured a strong aircraft industry to preserve a long peace, airports must be provided in as widespread fashion as possible, just as highways were provided for the automobile industry, and for the country's motorists."

★ Too Many Enemies of Road Progress

This seems to be our day to be burned up over things. One burner is simmering under the highway user groups who consider as a red flag any legislative or congressional attempt to increase state gas taxes, license fees or special truck and bus taxes, or any proposal to hold the status quo on federal excise taxes on motor vehicle manufacture. The latter case is in our grist of mail today—quoting testimony in Washington against continuation of the excise taxes.

One of the sound rocks on which federal highway aid is founded is the fact that the federal government, in providing a federal road contribution, is merely paying back to the auto and truck users what it takes in from them indirectly in excise taxes as the vehicle comes off the assembly lines.

Knock out that tax and you kick over one of the sound arguments for continuing federal aid.

And as to state highway revenues, what in the heck will we use for money to build roads if not the present state revenue sources? Present taxation plus federal aid have thus far given us a quarter-century of road development on an astonishingly even keel and at a pace without precedent in world history. Because of inflation gas taxes must go up or road programs go thin. But in California and elsewhere powerful "friends" of the road business have had other ideas.

Production is the Payoff...

...with FIRESTONE TIRES *and* PROJECT SERVICE

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For further details, and without obligation, write Project Service Engineering, The Firestone Tire & Rubber Company, Akron, Ohio.

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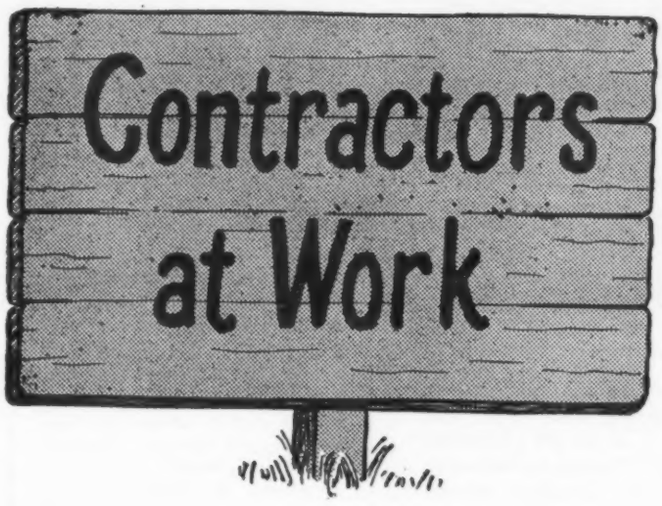
Firestone OFF-THE-HIGHWAY TIRES

★ Batch trucks crossed over the paver subgrader via a bridge carried on the machine



Ballenger Paving Co.
US 1 North Carolina

UNDER prime contract of E. W. Grannis of Fayetteville, N. C., the Ballenger Paving Co. concrete-paved three project sections of US 1 north of Raleigh during 1946. The new alignment, eliminating kinks and a couple of rail crossings, is a partial relocation which provides for easy widening later, according to state construction engineer W. E. Haskins.

The Ballenger equipment comprised both old and new units. In addition to fighting a tough battle on equipment repair and replacement, this contractor also had a typical 1946 year of labor headaches.

The pavement is 8-in. uniform p.c. concrete, 22 ft. wide, with 1½-in. parabolic crown. Ballenger elected to complete it in one pour. Other design details included; longitudinal dummy

★ Form trencher worked with a stringline to gauge proper depth

★ The batch plant was located along a 10-ft.-high railroad siding, an arrangement which increased stockpile capacity

★ Blading to maintain subgrade surface just ahead of the paver

TO BEAT YOUR ESTIMATE WHEN THE GOING GETS TOUGH

Two Ransome 34E Single Drum Pavers, owned by J. A. Utley Company, Michigan contractor, delivering concrete directly into forms

Concrete for this big Michigan auto factory site was batched at a central mixing plant. Ground conditions kept truck mixers from getting close to the forms. Bridging the gap with crane-carried buckets would have shot costs up far beyond the estimate. So . . .

Ransome Blue Brute Pavers were called in. From well back of the excavated dirt mounds their "live booms" swung their hydraulically-controlled buckets directly over the forms. Spillage was eliminated by the bucket's hydraulic shut-off when the forms were filled . . . Another construction problem solved!

More About the "Live Boom"

It spreads over a wider area with every swing, eliminating hand shovelling . . . Boom can be elevated to 9-ft. clearance under bucket, while paver concretes retaining walls, etc., and lays the slab — all in one operation. *Only Ransome Pavers include the "live boom" as standard equipment.*

Get the Whole Story

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BLUE BRUTES

Your Blue Brute Distributor will be glad to show you how Worthington-Ransome construction equipment will put your planning on a profitable basis.

RANSOME EQUIPMENT

Pavers, Portable and Stationary Mixers, Truck Mixers, Pneumatic Placing and Grouting Equipment and Accessories.

WORTHINGTON EQUIPMENT

Gasoline and Diesel Driven Portable Compressors, Rock Drills, Air Tools, Self-Priming Centrifugal Pumps and Accessories.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

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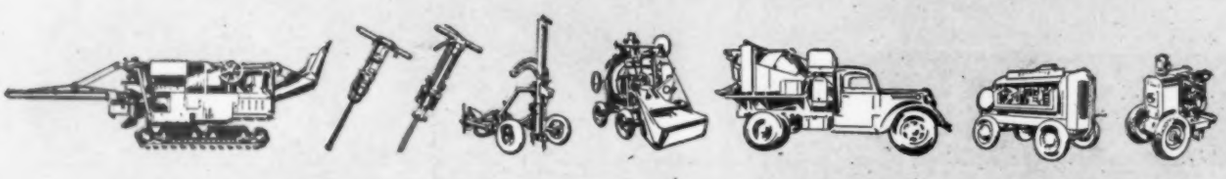
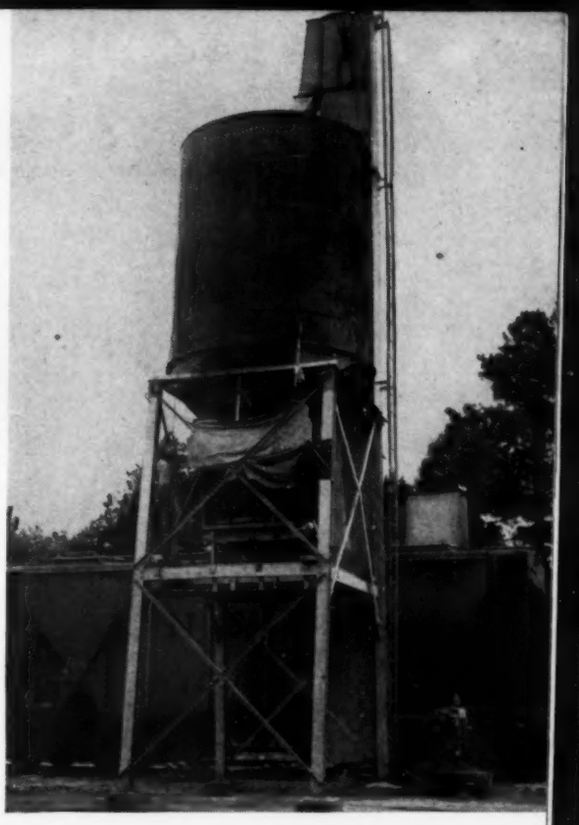


IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB

★ Tank truck in center, for water storage on the job, kept several hundred feet ahead of paver. Pump in rear delivered water to paver at desired pressure. Small pump on front of storage truck supplied water from delivery truck in front



★ (Right): How bulk cement was unloaded directly from cars into storage bin

★ Concrete spreader carried pneumatic vibrator which was used along forms and at joints. Device which held dummy-joint dowels during pouring and spreading operations is being removed after spreader has passed over

joint with 2′x½″ deformed tie bars every 30 in.; transverse expansion joints at 120 ft. with dummies 40 ft. Exceptional care was taken to keep all joints sharply defined and free from excess concrete or dirt which might decrease their effectiveness. During grading operations a 3-in. subbase of carefully selected granular material was placed and thoroughly rolled. Paver and batch trucks operated on the subgrade, since the 10-ft. shoulders were too narrow. Periodic openings in the forms allowed truck turn-around and minimized backing.

Mix water was supplied under pressure from a large truck-mounted storage tank, traveling a few hundred feet ahead of the paver. A portable pump fed water from the storage tank to the mixer at the desired pressure. A small pump mounted on the storage tank emptied the water supply trucks.

The batch plant was located at rail siding which was about 10 ft. higher than adjacent ground. The difference in elevation made unloading and stockpiling of aggregates somewhat easier, as the stock piles could be kept closer to the track. Bulk cement was delivered by rail, batched from a modern plant on level ground nearer the job.

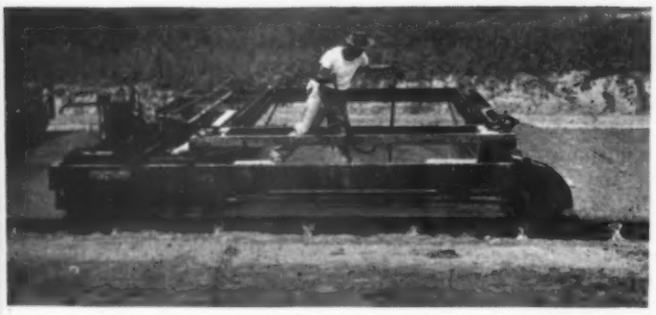
★ (Right): Note dowel-holding devices piled along shoulder and flat-bed truck using shoulder to haul dowels and supplies. Low-slump concrete was easily handled in very hot weather by mechanical spreader

★ ★

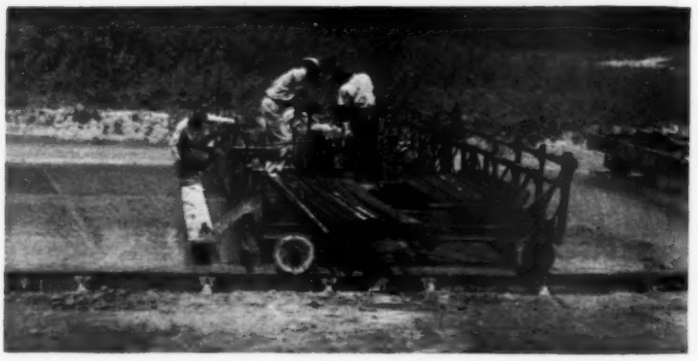
★ A modern dual-drum 34E paver pulled a subgrade shaper as it progressed

★ Membrane curing compound was applied with a hooded spray bar. This operation made possible an even coating regardless of wind

Ballenger's Job in N. C.—More Pix



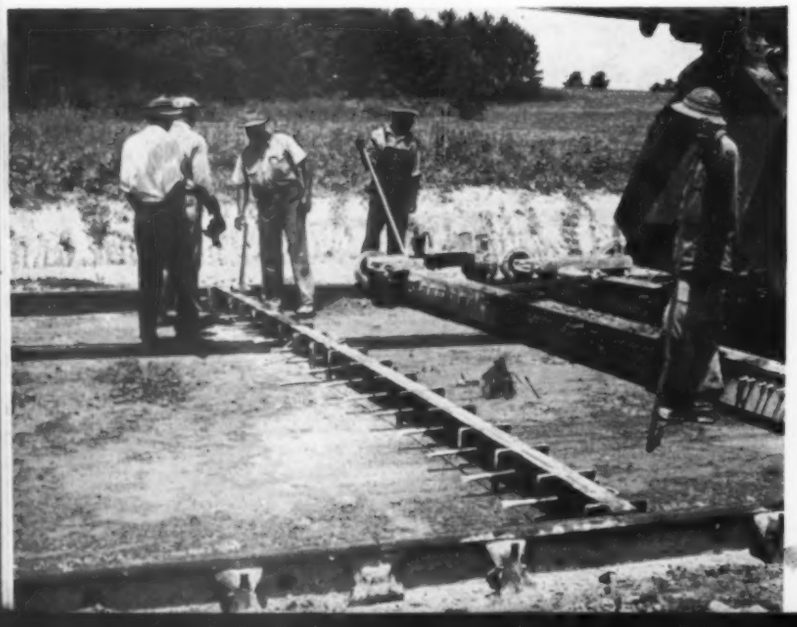
★ (Above): Transverse finishing machine followed immediately behind mechanical spreader. This machine also is equipped with a spreading device which in effect fine-graded the concrete ahead of finishing. (Below): A longitudinally-acting finishing machine removed any possible waviness



★ A jointing machine cut longitudinal and transverse expansion joints and also provided a bridge for hand-finishing these joints. Final finishing by hand-operated belt

See Next Article Page

★ Dowels for transverse, dummy and expansion joints were placed by a mechanical device immediately behind subgrade shaper. Shown here are the capped dowels and spreader for an expansion joint



★ R. H. Homewood of Chapel Hill, N. C., had contract for bridge widening at cost of $70,166, which was in excess of original cost of bridge. Pulpwood piles being driven for form shoring

HEAVY-DUTY JOB?

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THE TRUCK FOR *all* HEAVY WORK *all year 'round*

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A 5-ton FWD Model SU patrolling rugged, winding Cameron Pass, Colorado. *At left:* An FWD Model HA, taking on a load of gravel . . . one of large South Dakota fleet used also for snow removal, as well as road construction and maintenance.

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INTERNATIONAL

Efficient Dirt Moving Hems in Old Man River

THREE International TD-18 Diesel Crawlers moved 150,000 cubic yards of black gumbo, sand and clay, in 60 calendar days. They were rebuilding a levee near West Memphis, Arkansas, on the Mississippi. Hauls were as long as 1200 feet, weekly yardage as high as 30,000. And they loaded at small borrow pits *without pusher assistance* to get capacity loads in 10-yard scoops. Only one additional crawler, a TD-14 with "Trail-builder," was needed to level the haul roads, dress levee to grade and spread dirt deposited by the TD-18's and their scoops.

Performance like this points up the superiority of International Diesels for earth-moving. Their 4-cycle valve-in-head engines provide dependable, economical power. Perfect weight distribution, adequate ground contact, rugged construction and extremely durable moving parts give them the ability to handle the tough earth-moving jobs with ease.

Their in-built, quick-starting system means that they waste no time getting to work. And the little time required for

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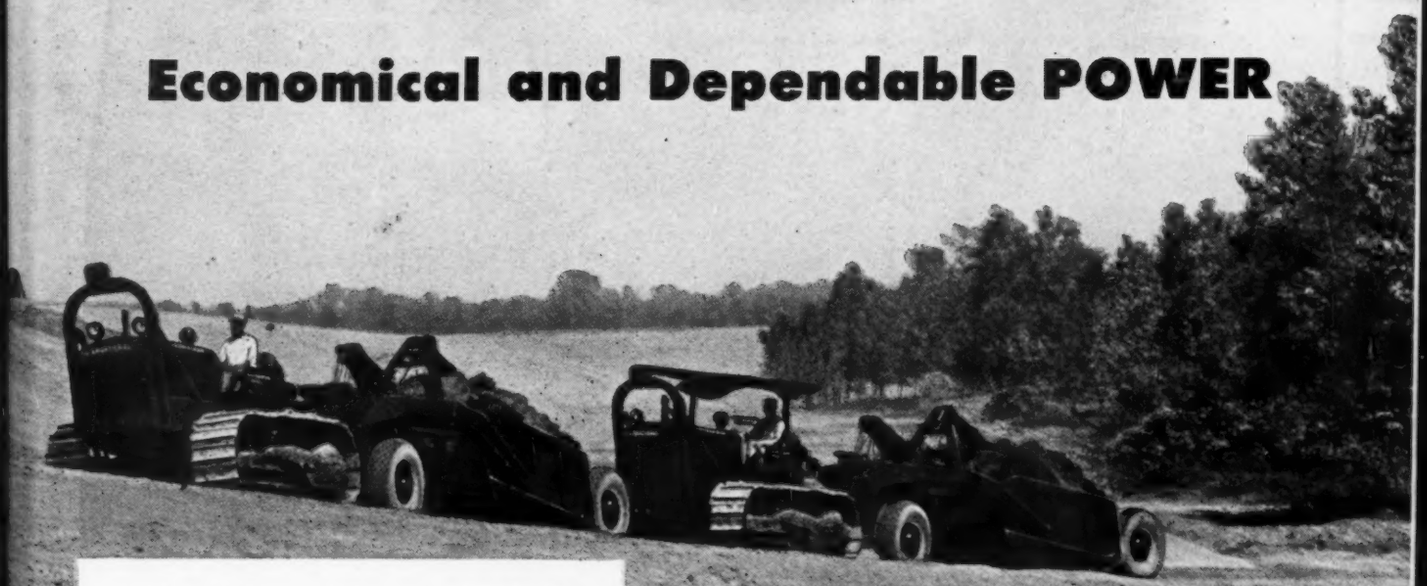

maintenance means *more productive hours* in every day.

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Contractors at Work

How Max Zeller Placed Bituminous Widening in Ohio

★ Widening area of berm loosened by motor grader with scarifier attachment

By Fred W. Kimble

Engr. of Bituminous Construction, Ohio Department of Highways, Columbus

U. S. ROUTE 40 from Springfield east has been resurfaced with bituminous concrete almost to Columbus within the last few years. The paved width of 20 ft. at the Springfield end, too narrow to carry the increased traffic, was widened 2 ft. on either side for 14 miles during 1946. The widening was for full-depth hot-mixed bituminous concrete, consisting of one 1¼-in. insulation course of limestone screenings; two 3-in. hot-mixed base courses; one ¾-in. hot-mixed leveling course, and one 1-in. hot-mixed surface course finished flush with the existing bituminous surface. Widening was built without use of side forms.

The design of this project was not unusual, but the method of construction is worth some comment. The contractor was Max J. Zeller of Columbus, O. Work was so organized that the operation moved continuously along one side of the existing pavement allowing maintenance of traffic on the other side. The continuous operation required more equipment than the contractor owned and it was necessary for him to rent rollers.

★ Rear view of trenching machine. This machine excavates to grade eliminating necessity of hand work and leaves material below grade line undisturbed

The work was stretched out so that it extended about a mile along the side being widened. The first operation was that of a motor grader loosening the berm material in the widening area with a scarifier. Next followed a trenching machine excavating the widening trench to grade. The subgrade was then compacted with trench rollers ready for the insulation course. The insulation course was placed with a spreader box operating on the existing pavement and extending over the widening trench. A water wagon with proper spray bar then moistened the insulation material and trench rollers compacted it.

★ Compacting subgrade with trench roller. Compression roll weighs 300 lb. per inch width of roll. Trenching machine in background

★ Placing and checking loose depth of insulation course of limestone screenings. A 2-inch loose depth is required for a 1¼-inch compacted course

★ Completed work after a few weeks' service. Widened area is blending in with the existing surface. Berms were brought up with a course of crusher run stone with top size of 1 inch

★ Placing second 3 inch base course of bituminous concrete. Top size of stone is ¾ inch

★ Placing and compacting surface course. Top size of stone is ⅜ inch. Edge of the existing bituminous surface was sealed with hot asphalt cement immediately before placing the surface course

★ (Below): Trench roller compacting insulation course of moistened limestone screenings. About four round trips are necessary to properly compact

★

★

★ Sealing the vertical edge of the pavement after it has been cleaned. About 0.25 gal. per sq. yd. of MS-1 asphalt emulsion used

Two men with steel push-brooms then cleaned the pavement surface at the edge and the vertical edge. A small distributor followed with hand spray sealing the vertical edge.

Immediately following this operation was a spreader box, operating on the pavement, placing the first 3-in. base course and trench rollers compacting it. The operation of the second base course, leveling course, and surface course followed as soon as previously laid courses had cooled sufficiently to allow placing another course. Immediately before placing the surface course the edge of the existing bituminous concrete surface course was painted with hot asphalt cement to aid in securing bond between the new and old surface.

By this procedure the contractor was able to get a high hourly production from his asphalt plant and to cut the time of construction by several weeks. The trenching machine used to excavate the widening area is not an uncommon machine in this state. However, very few are yet in use as the machine was developed just before the war and there was no production during the war years. This machine is particularly useful in construction widening where no side forms are used. The outside vertical face of the trench is cut to a neat line and serves as a side support for the first course of base widening and the insulation. It should be mentioned that where widening is built without the use of side forms that a stepped construction is used at the outside edge. The second base is 3 in. wider than the leveling and surface course, and the first base and insulation courses are 3 in. wider than second base course.

The use of this trenching machine on widening and resurfacing jobs in this state is expected to become universal when the machines become available. Much time and labor are saved whether the widening is built with or without forms. Better results are probably obtained as the subgrade is undisturbed below grade line.

Houston's Expressways

II—Design of Earth and Pavement Structures

The following detailed account was prepared by W. J. Van London, Engineer-Manager for the Urban Houston Expressways, Texas Highway Department, in collaboration with J. C. Dingwall, Urban Planning Engineer, and F. A. Harris, Soils Engineer

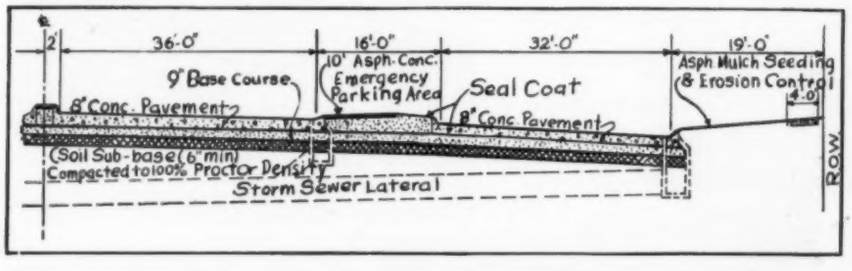
THIS article describes and discusses the design of earth and pavement structures for Section I of the Houston Urban Expressways now under construction, the methods and data used in arriving at the proposed design. [See May R&S for general project description and certain construction methods.]

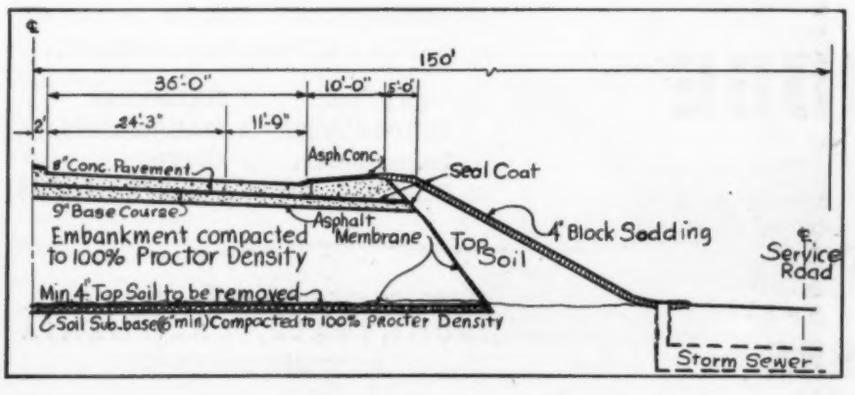
The drawings below show typical cross sections, ground level and on fill.

Sub-base Details

In all cases a minimum of 4 in. of top soil is to be removed. The 4-in. minimum will occur only where embankments are to be constructed. In other cases more than a foot of soil will be removed to obtain the desired grade line. After the top soil and excess earth have been removed the natural soil is to be compacted to 100% Proctor density to form the 6-in. sub-base. A greater sub-base thickness is not economically practicable because of the elevation of lateral storm sewers and the cost of manipulation in trenches under poor drainage conditions and high rainfall.

All storm sewers are to be constructed before the grading operations are started, and backfill compacted to the density of the natural soil and the inlet openings plugged so that the sub-base and base course can be uniformly compacted with the usual equipment without obstructions such as the completed drop inlets would introduce. After the base course is completed the inlets are to be brought to the grade of the base course or the pavement (optional with contractor). Excavation for inlets is to be to neat lines, or the backfill compacted to same density as the adjacent structure.





"Enclosed Membrane" Fills

The portion of the embankments supporting the paved areas is to be compacted to 100% Proctor density and completely enclosed in an asphalt membrane to minimize fluctuation of moisture content and consequent loss of stability. The embankment side slopes are to be plated with a minimum of 4 ft. of top soil which is to be compacted to from 80% to 90% Proctor density. This is a greater thickness than is considered necessary to support grass for erosion control, but the quantity of soil required will be available and it is considered advisable to provide sufficient thickness to prevent roots of any vegetation from penetrating the asphalt membrane, as this may result in fluctuation of moisture content.

As soon after completion as is practicable all slopes steeper than 6 to 1 will be block sodded with St. Augustine grass to prevent erosion; all other

★ Cross-sections—at ground level and on fill. Note "enclosed membrane" design

HARMS BROS. CONTRACT, CALIF. STATE HIGHWAY #24, CONCORD, CALIFORNIA

—with a fleet of FOUR Wooldridge Terra-Cobras

Widening and straightening a narrow winding two-lane bottleneck is another typical job calling for Wooldridge high-speed, self-propelled Earthmovers. Working in a 700 foot cut at the summit of Willow Pass on California State Highway #24, four Wooldridge Terra-Cobras maintained an average of 920 cubic yards per unit, per shift, over a 5000 foot round trip cycle, down and back a 15 to 30 per cent grade. Loading was effected in less than 75 feet, in 33 to 39 seconds. Soft clay, sand and adobe was spread on an 1800 foot fill at an average speed of 15 M.P.H. For high hourly averages on long or shorter hauls, you'll profit by investigating Wooldridge Terra-Cobras, today. Write for complete data and performance details.

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Now! LIFE INSURANCE EXPERTS PROVE THAT FORD TRUCKS LAST *up to* 19.6% LONGER

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4,967,000 Trucks Studied . . .

Wolfe, Corcoran and Linder, leading New York life insurance actuaries, assembled the records of all trucks of the five sales leaders registered from 1933 through 1941 . . . 4,967,000 trucks in all. Then they prepared *truck* life-expectancy tables in exactly the same way that they prepare *human* life-expectancy tables for life insurance companies.

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The result? Ford Trucks Last Longer! Up to 19.6% longer than the other 4 sales leaders! Why is this true? Because Ford Trucks are *built* stronger. They're *built* to last longer! That extra life that's put into Ford Trucks comes from Ford experience in building *more* trucks than any other manufacturer. Ford knows *how* to build trucks that last longer!

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Certified Proof

What Longer Truck Life Means to You . . .

Why It Pays to Wait for a New Ford Truck!

It stands to reason the longer you use a truck, the less it costs to own. That's why longer-lived Ford Trucks are the top truck value. And, logically, Ford longevity means lower maintenance costs . . . less time in the shop. It means more unused miles when you're ready to trade, and a better trade-in. Yes, any way you look at it, you'll get more truck for your money with a Ford Truck . . . because Ford Trucks last longer!

FORD TRUCKS LAST LONGER!

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13.1% longer than that of Truck "B"
3.2% longer than that of Truck "C"
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OFFICIAL ACTUARIAL CERTIFICATE

Based on the application of sound and accepted actuarial methods to the actual experience as measured by truck registrations, we hereby certify that, in our opinion, the accompanying table fairly presents the relative life-expectancy of the trucks involved.

WOLFE, CORCORAN AND LINDER
Life Insurance Actuaries, New York, N. Y.

unsurfaced areas to be asphalt mulch seeded with Bermuda grass.

Special Care at Bridge Ends

All bridge ends are to be supported on abutments consisting of 30-in. diam. round columns spaced on 12 to 15-ft. centers with under-reamed spread footings. The approach embankments are to be completed as described above *before* abutment construction is started, except that the header-banks will have 2 to 1 slopes and will not be plated with top soil. Excavation for the abutment footings and columns is to be made to neat lines by boring through the compacted embankment. The footings and columns are to be cast in place without forming, the entire excavated area being filled with concrete.

Any backfill necessary below and behind the abutment cap, required to bring the embankment to the bottom of the base course, will be made with cement stabilized backfill, which is composed of base course material stabilized with 3 bags of portland cement per cubic yard. The entire area of the header-banks under the bridge is to be plated with a rough surfaced concrete slab.

The embankment load (max. height 12 ft.) on a fill so constructed should result in practically no subsidence of the natural ground after construction is completed, and it is believed that the design and construction methods described above will result in an earth structure in which very little movement will occur.

Continuous Flexible Base

The base course, a standard flexible base, will extend a minimum of 1 ft. outside the concrete pavement edge.

Where the distance between the edges of the base course would be less than 12 ft., as under the median divider and in some cases between the freeway and the service roads, it is to be continuous to avoid an earth pocket which might impound surface water detrimental to the base and earth sub-base. In these cases the base course will be brought to the top of the curbs and surfaced with a seal coat for the same reason.

The base course will also be brought to the top of the curb for a width of 10 ft. on each side of the freeways and surfaced to provide the 10-ft. emergency parking lane. This results in a greater thickness of base course than is necessary to support traffic loads on the emergency parking lane, but the difficulties encountered in constructing a ridge in the subgrade and sub-base some 12 ft. wide and 10 to 12 in. high, and the possible detrimental effects through impounded water, will probably offset any saving that might be made in the base course material.

An asphalt seal coat is placed on the base course to maintain the stability and contour of the base course until the concrete is placed and to protect the base course against water infiltrating through and at the edges of the concrete pavement.

Concrete with Wood Joints

Cutting and filling for the pavement subgrade are considered highly undesirable, therefore, the pavement will be placed directly upon the asphalt seal coat. Since variations of ½ in. in the base course are anticipated, the concrete pavement will be paid for on a cubic yard basis. In general, the slabs are to be 20 ft. in length with longitudinal parting joints 12 ft. apart. Sufficient reinforcing steel is used to prevent the 20-ft. slabs from separating at anticipated warping cracks and at parting joints. The transverse joints are to be equipped with adequate load transfer devices and filled with the most dense and elastic wood available (probably creosote treated southern yellow pine, red gum or cypress untreated).

The contraction of slabs due to falling temperature results in the opening of cracks, dummy joints and expansion joints. Water leaking through these openings softens the subgrade, causes pumping of joints and cracks and broken slabs. Dirt and granular material feeding into these openings prevent the openings from closing when the slabs expand. This is repeated with each contraction and expansion cycle and may cause pavement "blowups."

For an anticipated slab contraction of 0.35 in. an expansible joint material having a capacity of at least 0.50 in. expansion is to be provided.

Suitable expansible joint filler is not expected to be available. Pine or gum has rather high resistance to compression, 600 psi. to 800 psi. being required to compress it to 50% under use conditions, and is expected to expand to 85% its initial thickness when the pavement contracts.*

Earth and Pavement Structure Design

The earth and pavement structures are designed to carry a maximum wheel load of 14,000 lb. corresponding to H-20 loading, with a maximum slab deflection of 0.1 in. It is assumed that a combination of the most unfavorable conditions will occur at certain times; viz, maximum loading, maximum temperature stresses in the pavement, and a minimum stability in the foundation structures.

In spite of the controversial nature of the subject of determination of soil and base course supporting capacities, it is believed that the methods of testing and analysis adopted offer a sufficiently reliable and accurate basis of design. The perimeter-area ratio method developed by Prof. W. S. Housel (1) affords a satisfactory method of interpreting test data on various sizes of bearing test plates, and enables tests to be made on samples of convenient size. Other methods of testing and design, including tri-axial compression testing and field load tests, are being currently studied and the results of design calculations by all methods used will be checked by field observations and measurements during and after construction. (Figures in parentheses refer to literature references listed at end of text).

Application of Prof. Housel's principle to base course materials and asphalt pavements has been confirmed by Hubbard & Field (2). In addition, tests conducted by the Houston Urban Expressways Laboratory confirm the P/A (perimeter-area ratio) relationship for the soils and base course materials considered for these projects, provided the test specimens are of sufficient size to allow full development of the "pressure bulb" within the specimen. (See Figs. 3, 4, 7, and 8.)

Housel's Principle

Stated briefly, Prof. Housel's principle is as follows: For any given amount of allowable deflection or penetration, the bearing capacity of a soil or base material increases in direct proportion to the P/A ratio of the load bearing area. Having determined this fundamental straight-line equation or relationship between size of bearing area and the bearing capacity for any given soil or base material, the bearing capacity for any desired contact area can be determined directly from the straight line representing this relationship. The shape of the bearing area also has an effect. Round plates are used in this case to simulate the approximately elliptical tire contact area. Having thus determined the individual bearing capacities of the base course, subbase and natural subgrade materials by Housel's principle, the net bearing capacity of any combination of these three "layers" supporting the pavement can be determined by a procedure developed in the Houston Urban Expressway office. This procedure is merely a "weighted average" computation based on the relative proportions of the total live load

*Texas research on wood joints will be described and commented on in a later article.—*Editor.*

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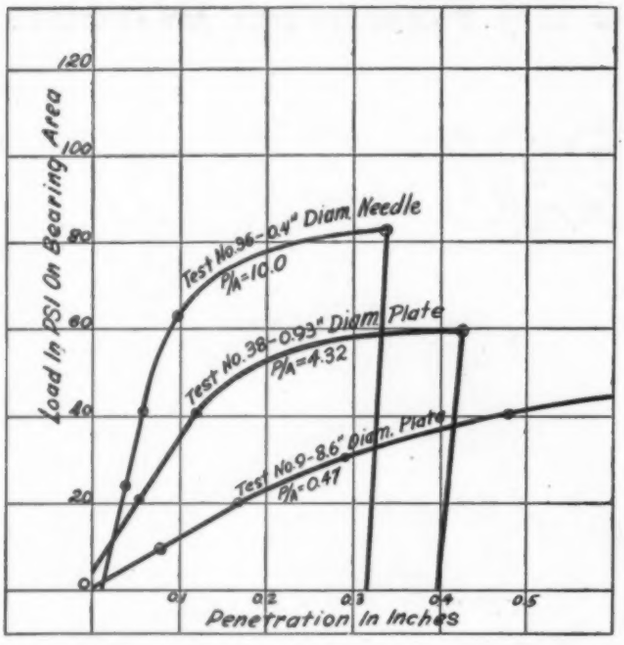
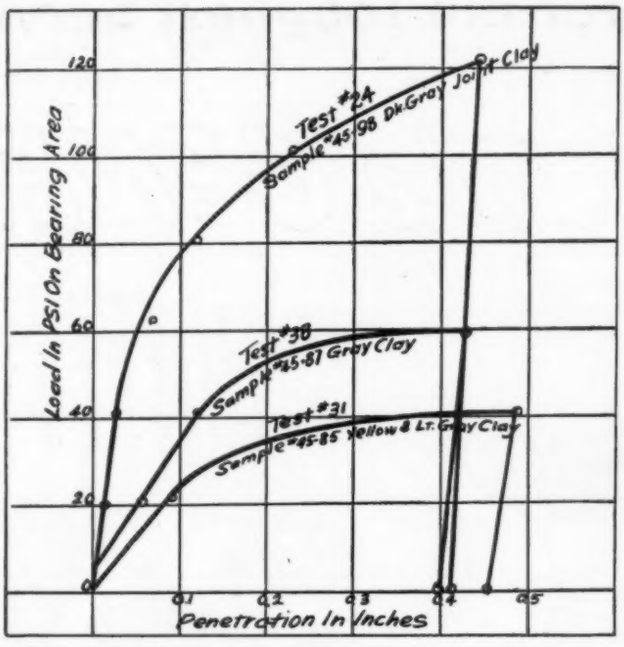


★ Fig. 1—Typical stress-strain diagrams showing effect of size of bearing areas. Compacted sub-base soil after absorption—sample #45-87, gray clay

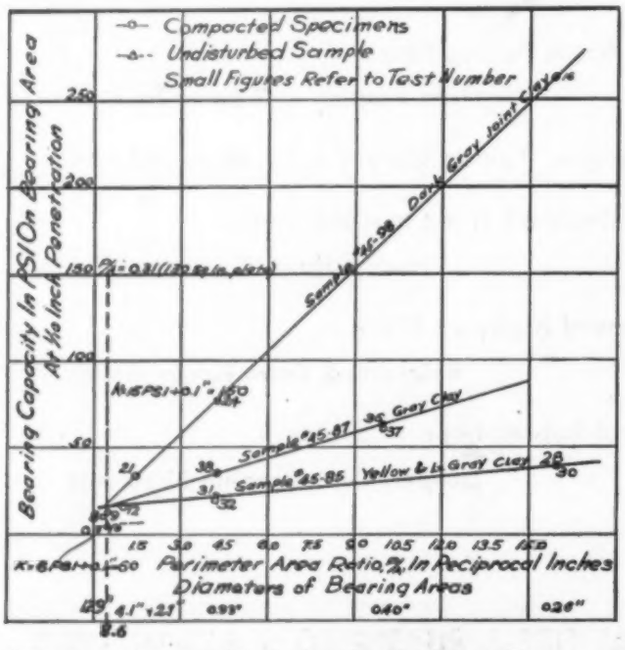

Load In PSI On Bearing Area
Penetration In Inches
Test #2A
Sample #45-98 Dk. Gray Joint Clay
Test #38
Sample #45-87 Gray Clay
Test #31
Sample #45-85 Yellow & Lt. Gray Clay

★ Fig. 2—Typical stress-strain diagrams showing variations in strength of various sub-base soils. Compacted specimens after absorption 0.93 diam. plate P/A = 4.32

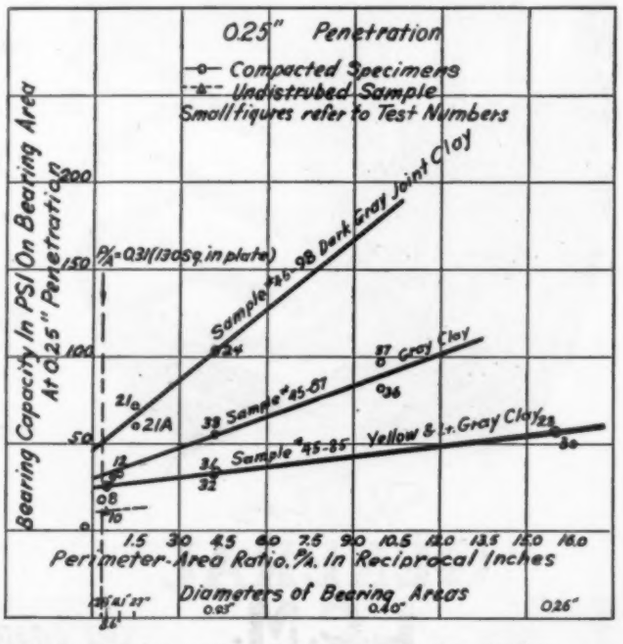
carried by each layer, the latter being determined by application of the theory of elasticity. This net bearing capacity has been termed "composite subgrade modulus", or "composite K-value".

Application of the Housel principle to design of the base course, subbase, and subgrade supporting a rigid pavement, involves a determination of live-load pressure distribution through the rigid pavement. For this purpose Dr. Westergaard's formulas (3) and (3a) were used to determine the critical pavement deflections, using values of subgrade modulus determined from bearing capacities for 0.1 in. penetration and a tire contact area of 130 sq. in. (P/A 0.31) by means of the test procedure just outlined. Additional slab deflections due to temperature warping were determined by formulas of reference (4). Then using Dr. Westergaard's fundamental assumption that the reaction of the subgrade is proportional to the pavement deflections, the vertical pressures transmitted from slab to base course at critical points were determined as the product of net pavement deflection and subgrade modulus, k.

The distribution of these critical pressures through the base course and sub-base were then determined by the method outlined in THD (Texas Highway Department) Design Circular No. 1-43 (7), which is based on an angle of load distribution of 26½° through base course and subbase. It is to be noted in this connection that for depths equal to or


Compacted Specimens
Undisturbed Sample
Small Figures Refer to Test Number
Bearing Capacity In PSI On Bearing Area At ½ Inch Penetration
Perimeter Area Ratio, P/A, In Reciprocal Inches
Diameters of Bearing Areas
Sample #45-98 Dark Gray Joint Clay
Sample #45-87 Gray Clay
Sample #45-85 Yellow & Lt. Gray Clay

★ Fig. 3—Bearing capacity of subgrade soils after capillary absorption—0.1 in. penetration


0.25" Penetration
Compacted Specimens
Undisturbed Sample
Small figures refer to Test Numbers
Bearing Capacity In PSI On Bearing Area At 0.25" Penetration
Perimeter-Area Ratio, P/A, In Reciprocal Inches
Diameters of Bearing Areas
Sample #45-98 Dark Gray Joint Clay
Sample #45-87 Gray Clay
Sample #45-85 Yellow & Lt. Gray Clay

★ Fig. 4—Bearing capacity of subgrade soils after capillary absorption—0.25 in. penetration

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OPERATION	GAUGES 1	2	3	4	5	6	ENG. R.P.M.	TEMPERATURE LEFT END	RIGHT END
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"BEST COMPETITIVE MAKE"									
SPRAY	37	35	42	41	43	43	300	290°f	280°f

The chart at the left indicates the exact pressure at each pressure gauge, along the entire 24′ length of spray bar. 85-100 penetration asphalt was used in making this test. The competitive machine, identified in this chart as make "A", under identical conditions, had a pressure variation of 8 lbs., and a *drop in temperature of 64°* at one end and a drop of 74° at the other end of bar.

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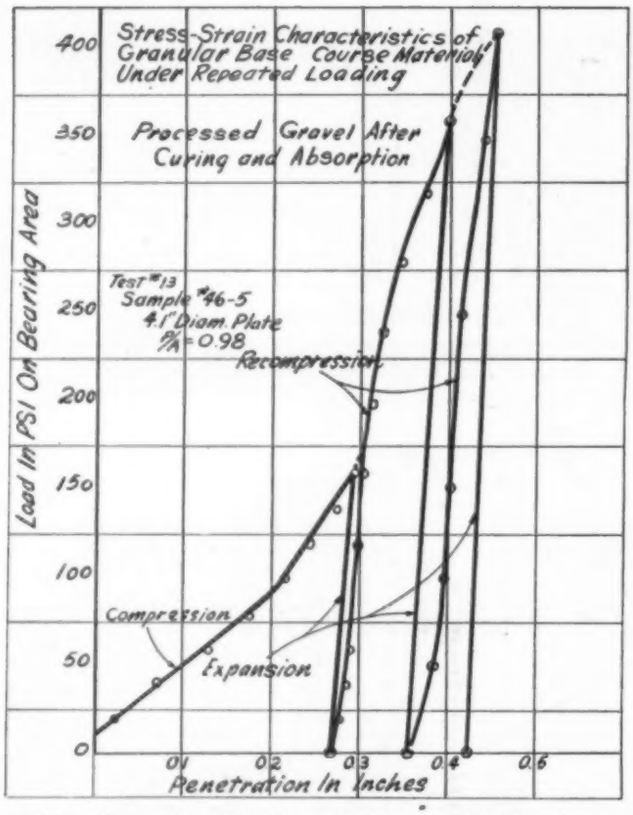
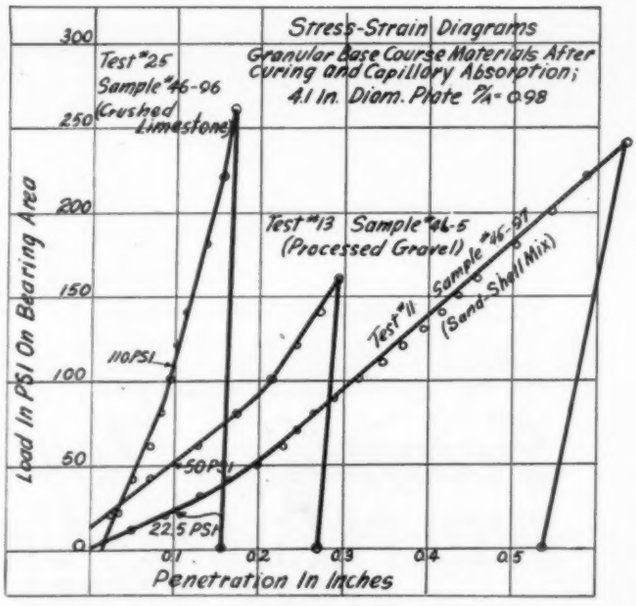




★ Fig. 5—Stress-strain diagram—granular base course materials after curing and capillary absorption; 4.1 in. diam. plate P/A = 0.98

★ Fig. 6—Stress-strain characteristics of granular base course material under repeated loading—processed gravel after curing and absorption

greater than the diameter of the loaded areas, the latter procedure gives values of soil pressures agreeing quite closely with those determined by application of the commonly accepted elastic theory, as is shown by the comparative curves of Fig. 10. The maximum vertical pressures so determined for each of the three supporting layers (base course, subbase and subgrade) were then compared with the corresponding bearing capacities to determine the relative stability of each.

Computing Slab Stresses

Having determined the factor of safety, or relative stability, of the supporting layers for various thicknesses of base course, it remained finally to design the slab itself with sufficient thickness and spacing of joints to resist the critical tensile stresses due to live load and temperature warping. Using minimum test results for the composite "k" value of base materials determined as above, then the load stresses at edges, corners, and interior of slab were computed by the formulae of reference (3), and the corresponding temperature warping stresses by Westergaard's formulas (4), and data taken from the Arlington, Va., experiments of Teller & Sutherland (5).

Poor Subgrade Soils

Preliminary soil survey indicated a very poor subgrade condition, the predominating surface soil types having high clay content, mostly of a joint structure, with PI over 25 and natural moisture contents in most cases more than either the plastic limit or the Proctor optimum moisture content.

In addition, the natural water table is as shallow as 10 ft. below grade line in normal conditions, and in cut sections at sites of proposed underpass is as high as 3 ft. below grade line. Three large samples for bearing value tests were obtained by combining samples representing the three poorest types, which are termed for convenience, dark gray joint clay, gray clay, and yellow and light gray clay. Identification and soil characteristics of these samples are shown in the Table (See Table I). One undisturbed sample 15.4 in. in diam. by 8 in. deep was obtained by test pit excavation in a typical poor subgrade soil.

The soil conditions noted above indicated the necessity for a base course between concrete pavement and subgrade. Large samples of all types of base course materials thought likely to be economically competitive in the Houston area were obtained from batch plants and gravel pits. After the usual quality tests these were combined (within economically practicable limits indicated by the respective material producers) where necessary to produce mixes meeting the desired specifications. Characteristics of the processed gravel, crushed limestone, and sandshell mixtures investigated are shown in Table II.

Bearing Capacity Test Procedures

Steel test cylinders of about 15 in. diam. and 8-in. depth were constructed with removable compaction collars, similar to the smaller standard Proctor apparatus, and with removable porous bottom plates. Preliminary tests indicated that 480 blows of the 5½ lb. Proctor hand tamper on each of four equal layers in this equipment produced approximately the same compactive effort as is produced by 25 blows in the standard Proctor test.

Specimens of subgrade soils were uniformly wetted to the optimum moisture content, compacted in the above manner in the large cylinders, and placed in a capillary tank with porous bottom plates submerged so that the bottom of each specimen touched the water level. The specimens were weighed and measured daily until no further absorption or swelling was detectable; the water level was then raised to near the tops of the cylinders, producing a positive head of approximately 8 in. of water at the bottom of each specimen.

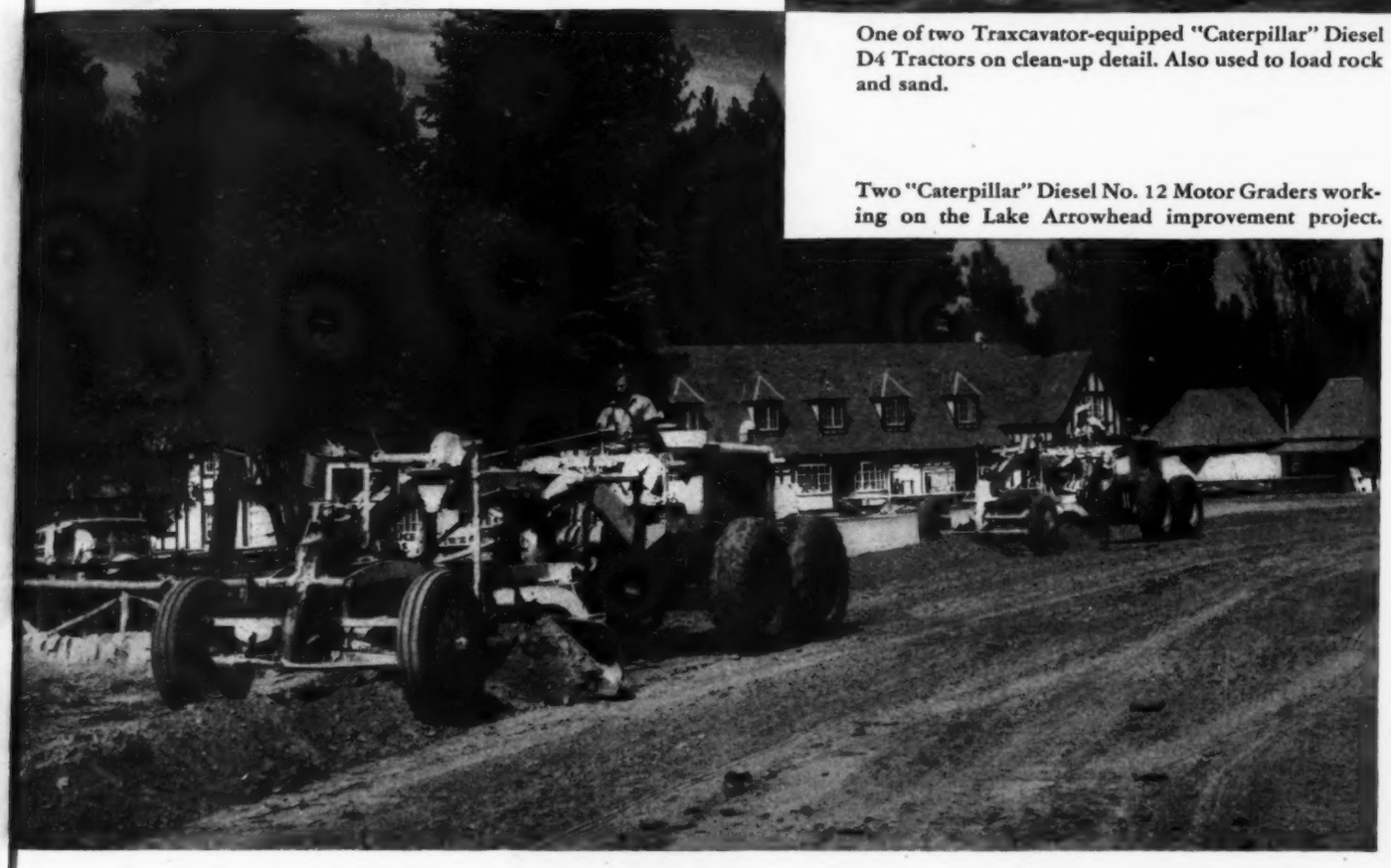
After maximum absorption and swell under the latter conditions, the soaked specimens were removed from the tank and immediately tested to determine bearing capacity. This was determined by applying various pressures to a circular steel plate set

(*Continued on page* 81)

Picture-village gets a "facial"

One of two Traxcavator-equipped "Caterpillar" Diesel D4 Tractors on clean-up detail. Also used to load rock and sand.

Two "Caterpillar" Diesel No. 12 Motor Graders working on the Lake Arrowhead improvement project.



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Minnesota Holds Asphalt Road Schools

This past spring seven one-day schools were held in various district offices of the Minnesota department of highways. Staged under the direction of the maintenance engineer and the engineer of materials, these meetings are similar to others held annually for the past seven years. Invitations were sent out to city and county governmental units. The 1947 gatherings attracted a total of 212, more than half being other than state highway employees. Maintenance foremen, district maintenance engineers, paving inspectors, city engineers and county engineers predominated, and the subjects covered in a 9-hour period included a resume of specification changes, unstable mixes and their control, patching mixes, seals, courses and correction of bleeding and slipperiness, and use of anti-stripping agents.

•

Detroit—Approximately $3,450,000 in right-of-way property has been acquired by the city for the John Lodge and Edsel Ford expressways, out of $19,300,000 total right-of-way cost. Work is in progress on two grade separation contracts and one sewer job totaling $1,270,000, and $7,000,000 additional contracts are expected to be let during 1947.

•

Postwar contracts for 2,891 miles of farm-to-market roads ($27,978,000) had been awarded by the Texas highway commission to date through this May.

Mail Inserted Card or Inquiry Blank (page 112) for Equipment Data

Again this issue of Roads and Streets carries descriptions of many new labor-saving efficiency devices and latest material developments. See our New Equipment and Materials Section beginning on page 99, for which a numbered reply card has been inserted to help you request data on items that interest you. Also on page 112 is an inquiry blank and advertisers' index which will help you get data on equipment and materials you need.

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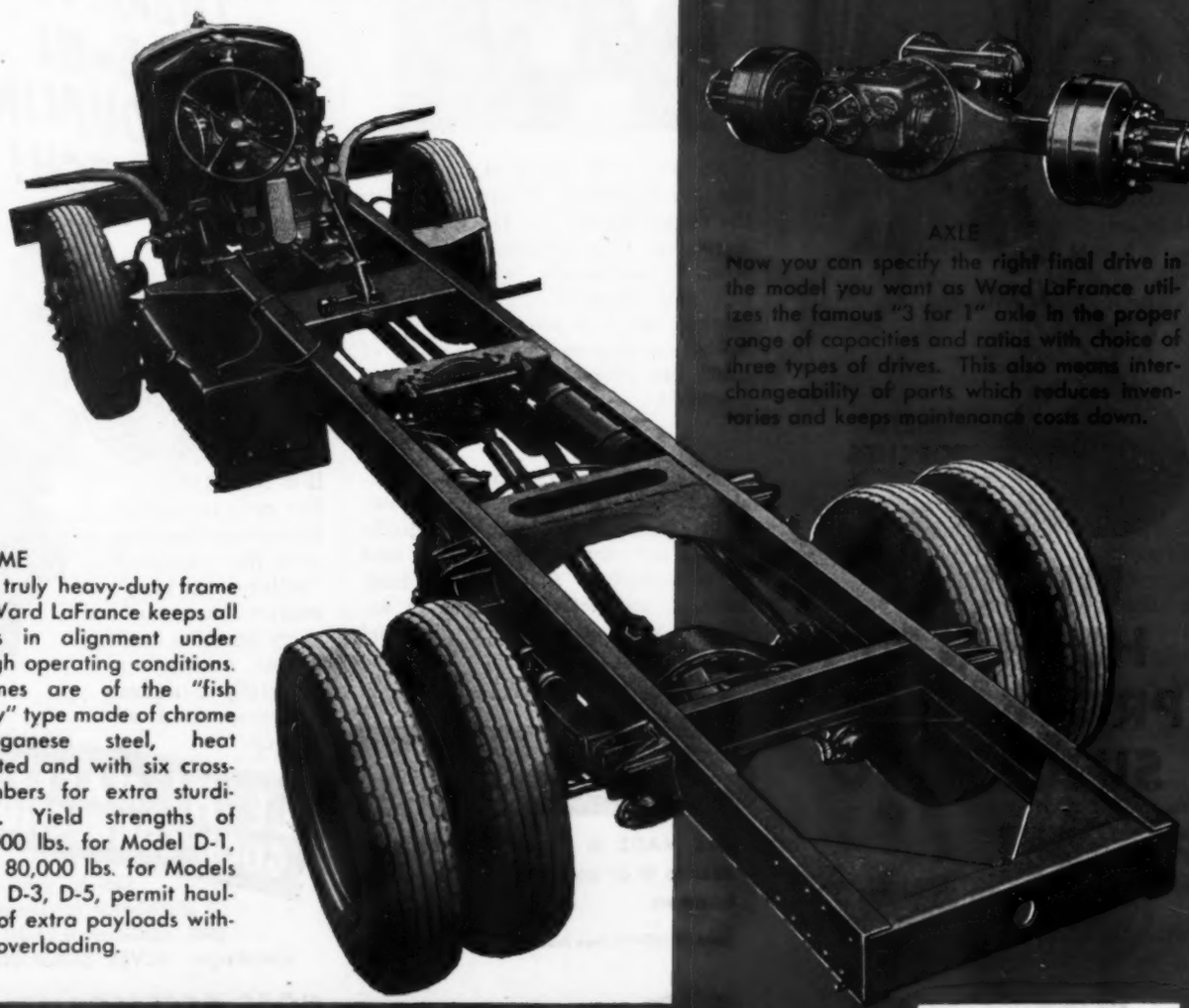

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The truly heavy-duty frame of Ward LaFrance keeps all units in alignment under rough operating conditions. Frames are of the "fish belly" type made of chrome manganese steel, heat treated and with six cross-members for extra sturdiness. Yield strengths of 60,000 lbs. for Model D-1, and 80,000 lbs. for Models D-2, D-3, D-5, permit hauling of extra payloads without overloading.

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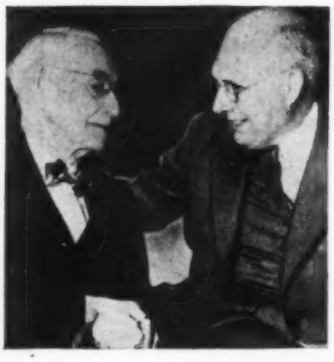
City Engineer Reaches 100th Birthday

Edwin A. Fisher of Rochester, New York, who served as city engineer of that city for many years, was feted recently at a testimonial dinner in his honor given by the Rochester Engineering Society. Mr. Fisher, who will celebrate his 100th birthday in July, has been accorded highest recognition in the engineering profession, among others having been elected an Honorary Member of the American Public Works Association in 1938.



Mr. Fisher is shown at the left in the accompanying picture receiving the congratulations of Dr. Charles F. Kettering, Vice-President of General Motors Corporation, who spoke on this gala occasion. The dinner also marked the 50th anniversary of the Rochester Engineering Society of which Mr. Fisher served as the first president.

●

Chicago—Congress Street expressway plans are in the right-of-way stage as yet. Among other real estate parcels the city and county are said to be spending $436,000 for land, damages and other expenses in acquiring a large cemetery plot and removing 797 bodies.

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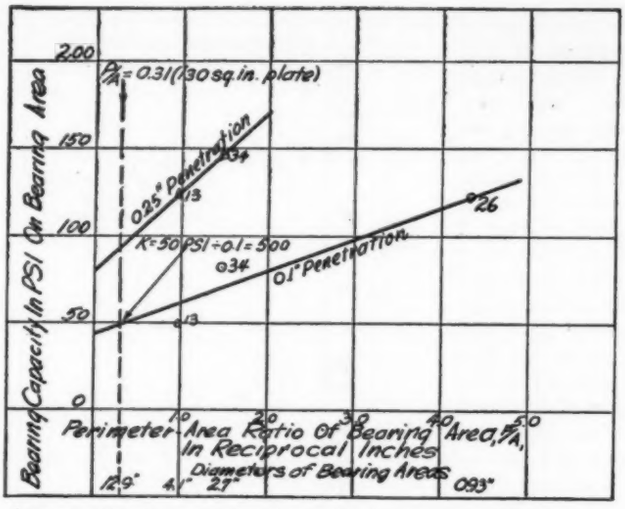
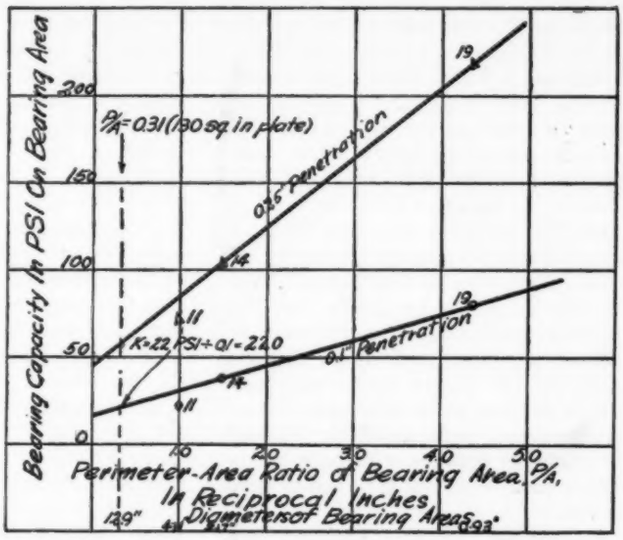


★ Fig. 7—Bearing capacity of granular base course material after curing and capillary absorption—processed gravel sample #46-5. Small figures refer to test numbers



★ Fig. 8—Bearing capacity of granular base course material after curing and capillary absorption—sand-shell mix sample #45-97. Small figures refer to test numbers

Test No.	Sample No.	PI	Proctor Opt. M.C %	Proctor Opt. Dry Wt #/c.f.	Proctor Opt. Air Voids %	Molded Specimen Blows Per Layer	Molded Specimen M.C. %	Molded Specimen Dry Wt. #/c.f.	Molded Specimen Air Voids %	Absorption Data % Moisture Absorbed	Absorption Data % Swell
12	45-98	38	25.0	95	7.5	380	24.9	87	14	0.2	1.5
16	"	"	"	"	"	25**	25.0	93	9	3.0	—
21	"	"	"	"	"	480	24.3	93	10	1.6	0.5
24	"	"	"	"	"	480	24.3	93	10	1.6	0.5
8	45-85	32	26.0	94	6.0	280	21.8	94	13	4.6	1.5
28	"	"	"	"	"	25**	26.0	95	4.5	2.3	—
30	"	"	"	"	"	25**	26.0	95	4.5	2.3	—
31	"	"	"	"	"	25**	26.1	95	4.9	3.1	—
32	"	"	"	"	"	25**	26.6	95	4.1	1.6	—
9	45-1 45-87	33	24.5	96	8.5	280	22.8	92	12.8	1.7	0.9
36	45-87	30	25.0	95	7.5	25**	20.9	99	8.9	3.9	—
37	"	"	"	"	"	25**	20.9	99	8.9	3.9	—
38	"	"	"	"	"	25**	19.0	102	9.1	3.8	—
10*	45-98	38	—	—	—	—	—	—	—	0	0.5

★ Table I—Soil characteristics and specimen molding data—subgrade soils

*Undisturbed sample, natural moisture content 33%; dry weight and air voids 83#/c. + and 8.7%, respectively, when tested.

**Small specimens compacted in 4 in. x 2½ in. mod. Proctor molds.

Test No.	Molded Specimens No. Blows Per Layer	Molded Specimens Moisture Content %	Molded Specimens Dry Dens. lbs/cf.	Molded Specimens % Air Voids	After Curing Moisture Content %	After Curing % Consolidation	After Absorption Moisture Content %	After Absorption % Swell
SAND-SHELL MIX SAMPLE #45-97 PI 2%, 26% Soil Binder (Proctor Opt. – 15% Moist, 118.5 lbs/cf, 5% Air Voids)								
11	380	16.6	114.2	3.1	7.4	0.4	15.4	1.0
14	480	14.8	119.8	1.8	8.6	1.0	11.2	.08
19	480	14.8	119.8	1.8	8.6	1.0	11.2	.08
PROCESSED GRAVEL SAMPLE #46-5 PI 6% 35% Soil Binder (Proctor Opt. – 8% Moist., 135 lbs/cf, 0.0% Air Voids)								
13	380	7.2	132.2	7.7	6.7	0.2	7.1	1.2
26	380	7.2	132.2	7.7	6.7	0.2	7.1	1.2
27	380	7.2	132.2	7.7	6.7	0.2	7.1	1.2
34	480	7.2	135.7	5.2	4.4	0.3	5.2	0.4
CRUSHED LIMESTONE SAMPLE #46-96 PI 4% 20% Soil Binder (Proctor Opt – 8% Moist, 136.5 lbs/cf, 0.0% Air Voids)								
25	480	7.6	141.2	0.5	0.8	0.7	5.3	0.5
40	480	7.6	141.2	0.5	0.8	0.7	5.3	0.5

★ Table II—Soil characteristics and molding, curing and absorption data on granular base course materials

(*Continued from page 76*)

firmly on the surface of the specimen and measuring the penetration of the plate produced by each load. A zero load of 2 psi was applied to the plate before starting the test to produce a firm seating of the plate upon the specimen; loads were applied in equal increments and each load allowed to act for 30 min. After the desired maximum penetration was attained, all load was removed and the rebound or expansion of the specimen measured. The specimens were then removed from the cylinders and moisture specimens taken from various sections to determine average moisture content and degree of uniformity of the specimen. Tests were run in this manner using separate specimens for each of the various size test plates varying from 0.93 to 8.6 in. diam. The test equipment was so designed as to allow loading of the specimens in either the THD beam breaking machine or the THD Modified Bearing Value Machines. (See Fig 14).

Also Smaller Specimens

Smaller specimens were also prepared in modified Proctor molds and soaked in capillary tank according to test procedure THD 98 for tests using smaller bearing areas. These

specimens were tested by applying loads to the standard 1/20th sq. in. (0.26 in. diam.) needle in the Modified Bearing Value Machine according to the same schedule of loading as used in the larger specimens. A special needle of 0.4-in. diam. was also used in the same manner. The size of the various plates and needles used was selected so as to give an approximately equal variation of P/A values over a wide range. Test results on small specimens and the smaller bearing areas were found to follow the same basic P/A relationship as the larger specimens, provided testing procedure and sample preparations were identical. Use of the smaller specimens greatly facilitated completion of the testing program.

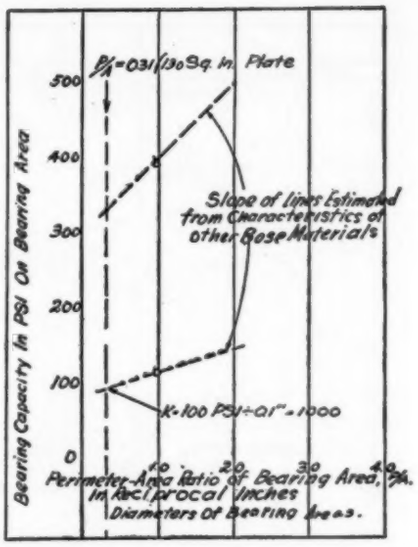
Specimens of the various base course materials were prepared in the 15" x 8" cylinders in the same manner as the clay specimens, but were allowed to cure in the laboratory atmosphere until an appreciable "set" occurred (usually 5 to 7 days) before placing them in the capillary tank. With the bottom of each specimen touching the water surface the specimens were weighed and measured daily until the top surface changed color and observations indicated maximum water absorption. The specimens were then removed and the top surface of each tested for bearing value using plates ranging from 8.6 to 0.93 in. diam. in the same manner as for the clay specimens. The smaller bearing areas were not used on base course materials due to presence of aggregate in the specimens larger than the smaller bearing areas.

Test Results—Sub-Base and Sub-Grade Soils

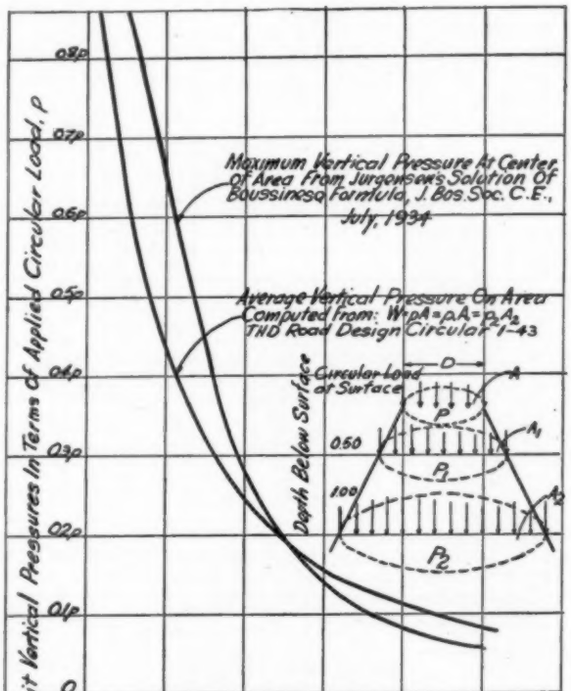
Table I summarizes molding and absorption conditions for the three typical soils tested. The three stress-strain curves show the variation in bearing capacity of the three soils. The magnitude of variations in bearing capacity due to size of bearing area used in testing is clearly indicated by the curves, Fig. 2, representing tests on three specimens of the same soil prepared in the same manner, but tested with different sizes of bearing areas. These two conditions indicate the necessity for complete investigation of each soil type, and for a rational means of interpreting the effect of size of bearing area.

The curves, Fig. 3, clearly confirm the P/A relationship for the three soil types and indicate the basis for k value determination as well as bearing capacities for 0.1 in. penetration applicable to design of concrete pavements. Fig. 4 shows the P/A curves for 0.25 in. penetration applicable to design of asphalt pavement or unpaved roads, and shows the same general relationship between soil type, size of bearing area, and bearing capacity.

Attention is invited to the condition revealed by Test No. 8. The low bearing capacity indicated in Figs. 3 and 4 is attributed to the fact that the specimen was too small to contain the full pressure bulb developed by the 12.9 in. diam. plate (specimen 15.4" x 8"), since as shown by Fig. 11 the size of the pressure bulb is about twice the diameter of the loaded area for the case of a circular plate according to the elastic theory. Tests conducted by Prof. Housel (1) and others also confirm this condition. Tests 9 and 10, representing 8.6-in. diam. plate on 15.4" x 8" specimen, appear somewhat low for the same reason. Accordingly, all subsequent tests with 15.4" x 8" diam. specimens were made using plates of 4.1 in. diam. and smaller, and tests on 4" x 2½" modified Proctor specimens were made with bearing areas 1" and smaller in diameter. It will be noted that the straight-line relation holds true for the other tests shown.



★ Fig. 9—Bearing capacity of granular base course material after curing and capillary absorption — crushed limestone sample #46-96, test #25

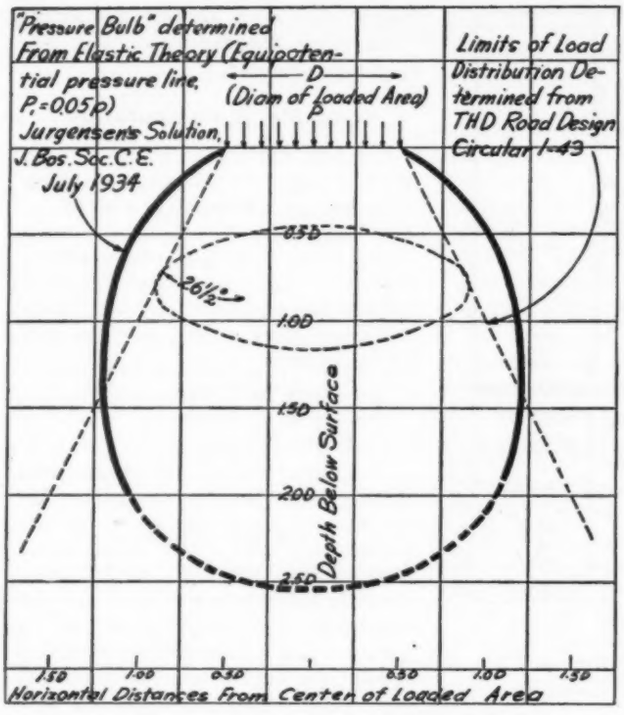


★ Fig. 10—Vertical pressures transmitted through soils and base materials by circular load at surface

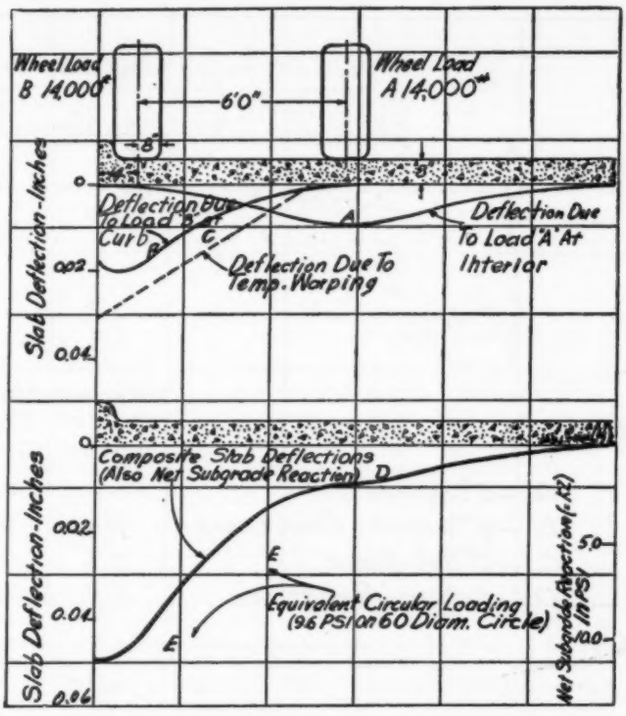
Values Converge

Another interesting feature of Fig. 3 lies in the convergence of the three P/A curves near the Y axis, indicating a bearing capacity of 15 psi for 0.1 in. penetration, or a k value of 150 for all of the compacted specimens for the tire contact area of 130 sq. in. (P/A = 0.31) in spite of the wide variation in slope of the three curves. That the bearing capacity of soils with high clay content should approach a relatively low constant value for very large bearing areas is to be expected because of the high cohesive strength of such soils, which characteristic denotes little actual supporting ability except to increase the amount of perimeter shear around the edges of the smaller plates. The latter effect is almost negligible for the larger bearing areas of the size encountered in tire contact areas of normal wheel loads.

Test No. 10, made on the undisturbed sample, shows a bearing capacity of approximately 6 psi for 0.1-in, penetration, or k value of 60, and bearing capacity of approximately 12 psi for 0.25-in. penetration. These data are considered to represent the absolute minimum bearing capacity to be expected in the undisturbed subgrade, since this sample was deliberately taken in a very poor soil and was further subjected to maximum capillary absorption in the laboratory before testing.



★ Fig. 11—Limits of vertical pressure distribution in soils and base materials showing extent of areas affected by circular loading at surface



★ Fig. 12—Graphical method for determining distribution of live load and warping pressures through concrete to granular base course; pressure transmitted is assumed proportional to slab deflection or $p = KZ$

Test Results—Granular Base Course Materials

Table II gives molding, curing and absorption data on the various specimens of base course materials. The data indicated a rather wide variation in drying and moisture absorption characteristics of the various materials during curing and absorption, but in general indicate that the specimens do not absorb as much water during absorption period as is lost during the curing period. It is believed that the absorption treatment to which the specimens were subjected represents the worst conditions that could prevail under actual use.

Fig. 5 shows two typical tests of base course materials which indicate wide variations in bearing capacities of different materials as was found to exist in the case of the subgrade soils. The reaction of the base course materials to loading is somewhat different than for clays, as will be noted, in that their stress-strain diagrams show a break and an increased strength after a penetration of from 0.1 to 0.2 in. is attained; this is believed to be due to strengthening of the material as a result of friction between the larger particles of aggregate.

Fig. 6 is presented to illustrate the strengthening effect of previously applied loads such as would be produced in the base course by allowing traffic consolidation of base course before paving. The rate of recompression is approximately equal to the rate of expansion and is many times less than the rate of initial compression, as shown by the slope of the compression, expansion and recompression portions, Fig. 6. This condition holds true until the applied load equals the previously applied load, after which the material reacts as if the load had never been removed. In the example shown the first recompression phase shows a k value of approximately 7,000 as compared to 500 for the initial compression. This indicates a 14-fold increase in supporting capacity.

Figs. 7, 8 and 9 show the P/A curves for each of three different base course materials for 0.1-in. and 0.25-in. penetration with corresponding k values for 130-sq. in. plate. The k values are shown to vary from 220 to 1000. Here again it will be noted that the bearing capacities of all the base materials tested varied directly in proportion to the P/A value of the bearing area.

Application to Slab Design

The following listed data are assumed constant throughout this example:

Concrete:

$E = 4{,}000{,}000$ psi. per inch.

Poisson's ratio = 0.15.

Heat Conductivity = 0.123° F. per ° F. per hr. See reference (6).

Coeff. of thermal expansion = 0.000005 in. per in. per ° F. (Based on results of Arlington experiments) see reference (5).

Flexural Strength, 28 days = 800 psi.

Granular Base Course:

Compacted to 100% Standard Proctor density and subjected to full capillary action.

Bearing value, 0.1-in. penetration = 22 psi.

Westergaard Coeff. of subgrade reaction, k = 220. (Minimum strength of all base materials tested.)

Sub-Base:

Natural soil compacted to 100% Standard Proctor density for depth of 6" and subjected to full capillary action.

Minimum Bearing Capacity = 15 psi for 0.1-in. pen. of 130-sq. in. plate.

Subgrade:

Natural soil subjected to a full capillary action. Minimum Bearing Capacity = 6 psi for 0.1" penetration of 130 sq. in. plate.

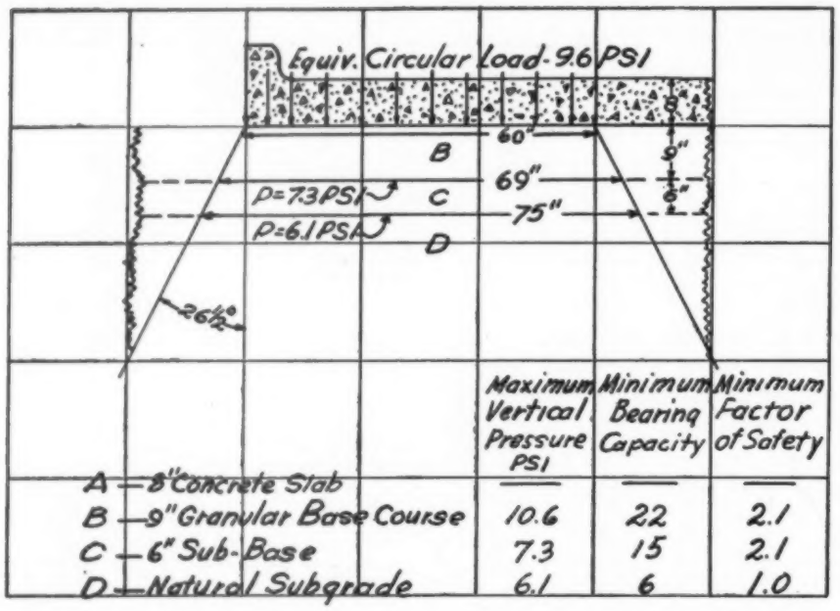
Maximum Live Load:

P = 14,000 lb. on one tire (H-20 loading 40,000 lb. total weight times 0.7 equals 28,000 lb. on rear axle, divided by 2 equals 14,000 lb. per wheel).

Tire Pressure—70 psi.

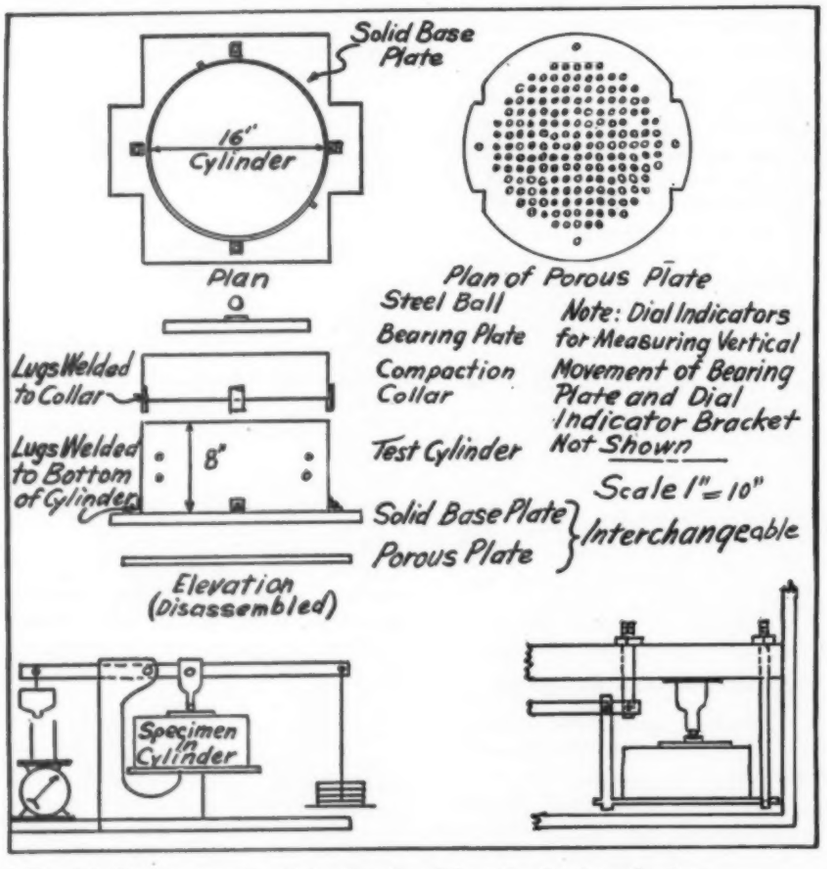
Contact Area 14,000 lb. ÷ 70 psi. = 200 sq. in.

Radius of Contact Area —A = 8 in.



★ Fig. 13—Stability of sub-base and subgrade supporting 8 in. concrete slab with H-20 live loading adjacent to curb and maximum temperature warping; for determination of "equivalent circular loading" see Fig. 12

Slab Details:
Transverse expansion joints 20-ft. centers.
Slab 37 ft. wide, with 6-in. curb on each edge, and longitudinal joints on 12-ft. centers.
Load transfer devices across expansion joints assumed 40% effective in transferring load across joint.
Maximum Temperature Condition:
Air-minimum 70° F. at 6:00 a.m.
Maximum 110° F. at 4:00 p.m.
Top and bottom slab 70° F. at 6.00 a.m.
Top of slab 10° F. higher than air at maximum temperature.
a. Load Stresses:



★ Fig. 14—Bearing capacity test apparatus. Schematic drawings showing method of loading test specimens in T.H.D. modified bearing value machine (left), and T.H.D. beam breaker (right)

Load Stress Computation

For 8-in, uniform thickness of slab (h = 8 in.) introduction of above data into equations 6, 9, and 12, of Dr. Westergaard's article, reference (3), and equation 21 of a later article, reference (3-a), gives the following values for maximum tensile stress at corner, interior and edge, respectively, of slab:

Corner—288 psi.
Interior—200 psi.
Edge—326 psi.

Equation (12) above for edge stress assumes the load to be applied at the exact edge of slab and to be distributed uniformly over a half circle with radius a = 8 in. in this case; actually the presence of the curb will eliminate the possibility of such a load and the maximum load condition would be a load distributed uniformly over a full circle of 8-in. radius with one edge tangent to the inside of curb, 6-in. from edge. This would represent the maximum condition of an H-20 vehicle traveling or parked with the outside edge of one tire just touching the curb. The effect of this limitation of maximum stress to a distance of 14 in. from the edge can be approximated by application of Figs. 8 and 9 of reference (3), which indicate a reduction of edge deflection of 23% for this condition. By applying the same line of reasoning as discussed by Dr. Westergaard on pages 107 through 112 of reference (3), the maximum edge stress is found to be:

$$e = 326 \times \frac{77}{100} = 251 \text{ psi.}$$

It is to be noted that this value is based on no allowance for edge reinforcement due to added slab thickness supplied by the curb. The stress of 326 psi. could occur only at an interior edge of slab where reinforcement in the dummy or construction joint would relieve the stress (by load transfer) by an amount at least equal to the effect of the 14-in. distance limitation on the curb side of the slab. Hence, the 251 psi. represents the maximum condition.

Figuring Temp. Stresses

Temperature conditions given above indicate the maximum temperature difference between top and bottom so slab will be approximately 30° F. For this condition and the 20 x 12 in. slab dimensions, Westergaard's equation (7) and Table IV of reference (4) gives the following maximum

values of tensile stress at bottom of slab due to temperature warping:

Longitudinal edge stress at curb —310 psi.

Longitudinal interior stress at center of slab—365 psi.

In the case of the corner of slab the stresses are zero at the corner, according to theoretical formulae of reference (4); however, the maximum load stress occurs at a distance of $x = 2\sqrt{a.l.} = 39.2$ in. measured diagonally from the corner. The temperature warping stress at this point is found from Fig. 40 of the report by Teller and Sutherland on the Arlington experiments, reference (5), to be:

$$c = 46 \text{ psi.}$$

Computed Stresses

The maximum combinations of live load and temperature warping stress conditions are summarized below for the 8-in. thickness of slab:

Corner

Load Stress	288 psi.
Warping Stress ...	46
Total	334
Less 40% load transfer	134
Net Stress ...	200

Edge (Contact area tangent to inside of curb)

Load Stress	251 psi.
Warping Stress ...	310
Total	561

Interior

Load Stress	200 psi.
Warping Stress ...	365
Total	565

The above conditions are considered adequate, giving a minimum factor of safety of:

$$FS = \frac{800 \text{ psi. Flex. Strength}}{565 \text{ psi. Max. Stress}} = 1.42$$

It will be noted here that no consideration was given in computation of the above stresses to the stiffening effect of interior reinforcing steel; the assumption here is that the steel, being located at the neutral axis of the slab, has no effect in resisting tensile stresses in the extreme fibers (top and bottom of slab). Actually the steel will stiffen the slab somewhat and can be expected to carry at least a part of the applied load, thus reducing the tensile stresses produced by the load.

Stability of Granular Base Course, Sub-Base and Sub-Grade

The vertical pressures acting on the top of the base course are assumed to be proportional to the pavement deflections as stated in a previous paragraph. The combination of conditions producing the maximum deflection at any part of the slab is shown on the upper half of Fig. 12. This maximum deflection condition is the result of an H-20 moving vehicle as close to the curb as possible, as used above in design of the slab, but with the added stipulation that this occurs late in the forenoon when the greatest difference exists in temperature of top and bottom of slab, and the wheel load is at an appreciable distance from either expansion joint. Assuming the wheel loads to be concentrated at the centers of their respective contact areas, Curves A and B of Fig. 12 show the approximate slab deflections produced individually by wheel loads A (at interior of slab) and B (at edge adjacent to the curb). These two curves were computed for the design conditions from the curves shown in Figs. 4, 8 and 9 of Westergaard's reference (3). Curve C shows the deflections produced by temperature warping of the slab as determined from equation 14, Fig. III, and Table IV of reference (4).

The three elastic Curves A, B and C are combined algebraically to obtain the elastic Curve D in the lower part of Fig. 12. This curve represents the net slab deflection due to the combined influence of loads A and B and temperature warping of the slab. Under the assumption $p = KZ$, this curve also gives the distribution of vertical pressures transmitted by the slab to the base course, the pressure being a maximum at the edge (where $p = 0.049$ in. $\times$ 220 = 10.6 psi.) and diminishing to zero at a point approximately 15 ft. from the edge. The pressure scale on lower right of Fig. 12 was computed from the relation $p = KZ$ and indicates the subgrade reaction or vertical pressure on the base course directly for any point on Curve D.

The stability of the base course itself is determined directly by comparing the maximum pressure of 10.6 psi. with the corresponding bearing capacity of 22 psi.; resulting in a factor of safety of 2.1.

Base Pressure Transmission

In order to determine the stability of the compacted sub-base and the natural subgrade, it is necessary to determine to what extent the pressures on the base course will be transmitted to the underlying layers. Mathematical solution of the case of loading represented by Curve D of Fig. 12 is not readily available in the literature, but an approximate solution can readily be obtained by replacing Curve D with an equivalent circular load of comparable intensity. The dotted Curve E of Fig. 12 contains the same area as Curve D and represents a uniform load of 9.6 psi. applied to the base course over a 60-in.-diam. area adjacent to the edge. The 60-in. diam. was chosen because the bulk of the pressure shown by Curve D lies within 60 in. of the edge. This equivalent circular load is considered to be applied to the top of the base course as shown in Fig. 13, and the maximum pressures in the underlying strata determined by the method of THD Design Circular 1-43 (26½° angle of pressure distribution). The maximum pressures so determined indicate factors of safety of 2.1 and 1.0 in the sub-base and the subgrade, respectively. These values represent the minimum factors of safety and are considered ample in view of the unfavorable assumptions necessary in the computations, and the combination of circumstances necessary to produce the worst conditions assumed as the basis for design.

It will be noted that the pattern of subgrade pressure distribution for the case of interior loads on rigid pavement such as represented by Curve A of Fig. 12 is identical with that produced by a circular loaded area on a plastic or granular material. Hence, for this case, the "equivalent loading" method outlined in the previous paragraph for the stress computation, and comparison of the pressures so determined with bearing capacities determined from circular load tests, involves no approximating assumption such as was necessary in the critical case of the edge and interior load combined with temperature warping effects represented by Curve D of Fig. 12. Also, for the case of Load A the warping effects are practically zero. The maximum pressures on the base course, sub-base and subgrade for interior Load A considered alone are such as to give factors of safety of 11.2, 9.3 and 4.2, respectively.

Base and Sub-Base Design Conclusions

It can be concluded from the foregoing analysis that the strength of the base course and sub-base are more than adequate to support the 8-in. slab under all conditions, and that of the subgrade is more than adequate for maximum live loads applied to interior sections of the pavement, but that the pressures produced under the approximate curb line by maximum live loads at the curb at certain times daily will approximate

(*Continued on page* 98)

2-Way Radio Now Available

for state and county highway maintenance

On application state and county highway departments can have frequency assigned for official highway purpose. Stations to be classed as "experimental" for present. Departments everywhere urged to begin at least limited use.

WE'VE had radio communication on snow plows for several years. Now any state or county highway department can equip with radio-telephone for broader use, under a Federal Communications Commission ruling, dated April 21, 1947.

This news, which is of great economic significance to road organizations, is the result of long, hard work by the AASHO's subcommittee on use of radio. In order to give ROADS AND STREETS readers the full details of recent developments, we present herewith part of a letter sent May 13 to all state and county highway departments by T. H. Dennis, chairman of the subcommittee and maintenance engineer, California.

"During the past year, the 'Subcommittee on Use of Radio, American Association of State Highway Officials,' has been making an effort to secure from the Federal Communications Commission allocations of radio frequencies assignable to highway departments. The radio committee has, at the same time, attempted to secure revision of existing FCC Rules and Regulations to include a highway maintenance class of station with broad permissible scope of use. The establishment of such a station with this broad defined use would economically justify installation of radio communication in all highway departments.

Three Frequencies

"Attached, for your information, is a copy of a letter dated April 21, 1947, from the Federal Communications Commission which advises they now have 3 frequencies—37.98 Mc, 72.10 Mc, and 72.34 Mc—for highway departments. Upon specific application, they will assign one of these frequencies for a highway maintenance class of station to be owned and operated by the highway department.

"In order to determine how extensively the highway departments will avail themselves of this new permissible use of radiotelephone, they have temporarily classed these stations as "experimental" and in a development status which permits a broad use. The following is the limit on the use of radiotelephone for official highway purposes under Part 5, Class 2 Experimental (Highway Maintenance) stations, Section 5.74 of the Federal Communications Commission Rules: (a) Interference will not be caused to other stations regularly licensed. As there are no stations other than highway maintenance on the frequencies, there should be little interference.

All Urged to Apply

"If you plan to use a radiotelephone in the near future, it is suggested you apply to the Federal Communications Commission for a frequency assignment at an early date in order to indicate the extent of interest highway departments have in the subject. In order that the Radio Committee may continue to secure the advantages of the radio art for highway departments, it will also be appreciated if you will let me know how soon and to what extent you may intend to install a radio system.

"We believe it is to the advantage of all highway departments to make immediate application for highway radio, even though on a limited basis. Such action on the part of all states would not only assure retention of privileges now granted by the Federal Communications Commission, but would aid materially in insuring allocation of additional frequencies in the event our future needs so required.

"Please do not hesitate to write this committee regarding further information you desire on use of radio."

[Committees: T. H. Dennis, Calif. (Chair.); H. A. Radzikowski, PRA (Secy.); D. N. Stewart, Colo.; C. W. Ross, Ill.; L. W. Marsh, Kans.; J. S. Watkins, Ky.; R. B. Richardson, La.; H. T. Ward, Mich.; C. L. Motl, Minn.; R. W. Whitten, Mo.; A. W. Muir, N. J.; V. L. Ostrander, N. Y.; E. W. Ellis, Ohio; C. B. Stanley, Ore.; W. K. Myers, Penn.; J. A. Anderson, Va.; E. L. Worthington, W. Va.]

Details from FCC

In a letter outlining the conditions, T. J. Slowie, secretary, Federal Communications Commission, explained that because the equipment presently used by stations operating in this part of the radio spectrum will not permit adjacent channel operation on channels of 40 kc width, only certain frequencies of those listed in the above-mentioned mimeographs are immediately available for assignment. These channels are in the 30-40 and 72-76 Mc bands.

A proposed plan for specific assignment of the above listed frequencies to highway maintenance and special emergency stations is as follows:

33.02 Mc	Special emergency stations
33.10 Mc } 37.90 Mc }	Held in reserve until vacated by police
37.98 Mc	Highway maintenance stations
72.10 Mc	Highway maintenance stations
72.34 Mc	Highway maintenance stations
72.58 Mc	Special emergency and provisional stations

"The Commission," this letter further states, "is presently revising Part 10 of its rules governing stations in the Emergency Radio Service to provide certain changes made necessary by current Commission policies. Among minor changes in the organization of the present Part 10, the Commission proposes to include a 'highway maintenance' class of station. It is expected that the proposed highway maintenance class of station will permit use of radio by highway departments on a basis equal to that for police, fire, forestry and other stations presently licensed in Emergency Radio Service. The final rules, before adoption, will be coordinated with the highway agency. It is further expected that these proposed rules will be ready for coordination within approximately three or four months.

"Until such time as a highway maintenance class of station is established, highway departments may be authorized a Class 2 Experimental station (Highway Maintenance) in the Experimental Radio Service. A Class 2 Experimental station is normally authorized to operate in a proposed service for the purpose of developing the service. This class of station is also authorized for the purpose of developing a new phase of an existing radio service.

"Although experimental authorizations connote a temporary type of station, your attention is invited to the statement in the third full paragraph on page 2 of Public Notice 3529 regarding the Commission's proposal for establishing a highway maintenance class of station on a regular basis. Since the frequencies now being assigned to Class 2 Experimental stations are the same as those which are allocated and will be assigned to highway maintenance stations in the regular service, it is expected that few, if any, changes will be involved which will require additional expenditures by the licensees of Class 2 Experimental stations when changing from the Experimental Service to a regular basis."

Clearing Airports

by New Snow Plowing Method

Describing a plowing sequence developed on a Wisconsin airport, utilizing high-speed equipment

By J. R. Shannon
Snow Removal Engineer,
The Four Wheel Drive Auto Co.

THE sequences of a new high-speed, more efficient and more economical system of airport snow removal are depicted in the accompanying diagram. The method employs a special new reversible plow designed to throw the snow in a layer of uniform depth for a width of 30 to 40 ft. with no windrow at the discharge end. Powered by a 4-wheel drive truck, this plow operates most efficiently at a speed of 25 mph.

Experimental airport snow removal work was begun in the winter of 1938-39, using the Clintonville, Wisc., airport as a testing ground. Various sizes of 4-wheel drive trucks and several types of highway snow removal equipment were tried. Although the landing field was kept open for wheel-equipped airplanes, it soon became apparent that methods and equipment would have to be radically different from those used in highway work, if the job were to be done economically and quickly enough to have a busy airport open to traffic immediately after a storm.

How Airport Job Differs

In removing snow from highways a narrow strip of roadway is cleared of snow, which is deposited a short distance from the edge. In airport snow removal it is necessary to clear much wider areas. For this reason some factors, which are relatively unimportant in highway work, become of extreme importance in airport work. Highway snow removal is accomplished almost altogether with displacement types of plows starting in the middle of the roadway and pushing the snow to the ditch line. If this method were used on an airport, after considerable snow has fallen, a bank of snow would accumulate large enough to stall a plow long before the snow had been transported off the operational area. With these considerations in mind, a new displacement

★ The new airport plow in action on the Clintonville Municipal Airport. The design of this plow and the speed of the truck throw the snow 30 to 40 ft. to one side without developing objectionable banks of windrows

type plow and new methods were developed, fitted to varied weather and wind conditions, which cut the time to clear airport areas to the very minimum.

None of the plows designed for highway snow removal were found suited to efficient airport plowing at high speeds. The requirement was for a hydraulic reversible plow with controls inside the cab of the truck. The plow designed from this research has a moldboard shaped so that snow is picked up by the whole length of the cutting blade and moved in a helical path across the face of the moldboard to the discharge end. Both the radius and curvature of the moldboard and the cutting angle were made large enough to permit the snow which was picked up at the lead point to travel across the face of the plow and be discharged at an angle above the horizontal at the upper trailing corner. In order to uniformly accelerate the speed of the snow from the lead point to the discharge end, the moldboard section was given a spiral shape. The cutting angle was made considerably greater than that used on highway plows. The high-cutting angle gave more side-thrust than is found in highway plows, but with power being applied at all times to all four wheels through a free running center differential, this excessive side-thrust was overcome.

Large Shoes Employed

Another special feature developed for the airport plow was long shoes, which gave the effect of permitting the plow to operate on a softer surface. The long shoes, shaped somewhat like skiis, also tend to bridge over irregularities in the frozen surface, causing the plow to run more smoothly. The plow shoes are adjusted to leave ½ to 1 in. of snow on the runways. This thin layer of snow is dissipated in a short time by the action of the sun, the wind and the propellor blasts of airplanes.

The Clintonville Municipal airport, where the tests were conducted, is a mile-square field. In its present state of development, it has three 150-ft. runways, with shoulders on the runways graded to a total width of 500 ft. The runways are 3,200, 3,600 and 4,100 ft. long, arranged about a central, intersectional area. The width of the area kept clear of snow was arbitrarily set at 300 ft., providing a permanent storage area of 100 ft. on each side of the runway.

Using the newly developed plow and clearing methods described below, a 125 hp. four-wheel drive truck completely cleared 4 in. of heavy, wet snowfall from all three runways and shoulders to a width of 300 ft. and removed all the snow from the intersectional area, in 26 hours. On another occasion an 8-in. fall of very wet, compact snow was cleared from the same area in 41 truck-hours.

Wind Direction Important

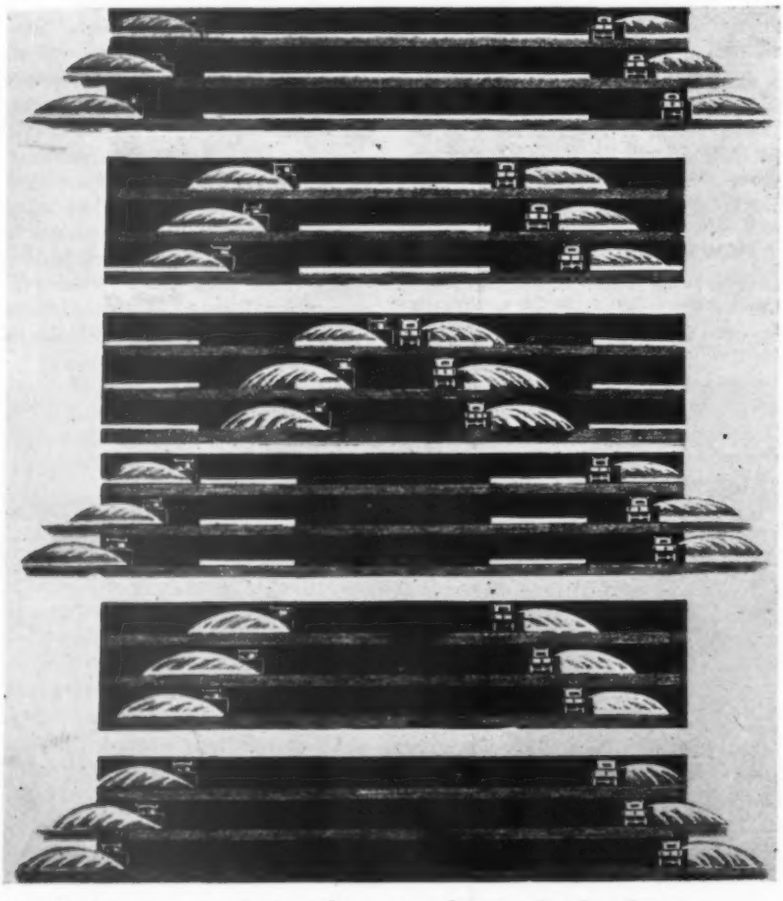
The engineers on this test found that it was very important to take advantage of the wind and move as much of the snow as was possible in a down-wind direction. It was also found important to plan the work so that snow was transported a minimum distance. On a long, narrow operation, best results were obtained when the plow was operated with the wind coming from the side and with the plow moving lengthwise of the area.

Cross-wind plowing, where the operation is started after the beginning of the storm, with considerable wind, and the temperature below freezing, eliminated the formation of objectionable snow banks. In storms of this kind operations were started on the upwind side of the cross-wind runway, and all snow was moved in a down-wind direction across the runway. Thus the cross-wind runway was cleared first. Since a wind shift can usually be expected immediately after a snowstorm it was found that this often became the windward runway after a few hours. By the time this runway was cleared, nearly half of the snow in the intersection area had also been removed. A part of the remainder was moved, also in a down-wind direction, by again starting at the upwind side of the next cross-wind runway after the wind shift. This second runway was cleared the same way as the first runway.

When Wind Absent

When a storm occurs with little or no wind, or where the wind during the storm is parallel with the length of the operational area, there was little advantage in moving snow in one direction only. In these cases it was found practical to move an equal amount of snow to each side of the operational area. Under these conditions, the plow was driven up one side and down the other, always moving the snow towards the outside of the operational area.

When the snowfall was extremely heavy, or where there was not sufficient equipment available to cover the whole field quickly, it was found that considerable snow accumulated before hauling operations could be started. Under these conditions the most practical results could be obtained by



★ Method for fast removal of wet, heavy snows from an air strip, using new airport plow. See accompanying text for detailed description

starting the plow 30 or 40 ft. inside of the boundary of the operational area and moving this 30 or 40 ft. strip over to the boundary. The second operation was to start another thirty or forty feet toward the center of the operational area, moving this snow onto the area previously cleared by the first operation. This was repeated until the center of the operational area was reached. Since this had been proceeding on both sides of the operational area, a cleared strip 60 to 80 ft. wide was left at the center. The next operation was to start back at the original location, 30 to 40 ft. inside boundary, and repeat this process until the plows reached the central cleared strip. At this stage the width of the central strip had been doubled. This technique was continued until all of the snow on the operational area had been moved to the boundary. However, a 60 to 80 ft. strip of cleared runway was available for use within a short time after the beginning of plowing operations.

Controlling the Banks

With little wind, and snow and temperature well above freezing, there is a tendency to form banks at the boundary of the operational area. In order to avoid dangerously high banks the snow was deposited in the form of a low, wide bank extending from the boundary 15 or 20 ft. into the operational area. After the storm was over and the area completely cleared, it was found that these banks could be eliminated by taking successive narrow cuts on the outside of the bank. This resulted in a series of windrows over a width of 40 to 50 ft. immediately outside of the boundary of the operational area. By raising the plow about 10 in. off the ground and driving over each windrow, the bank, which originally was about 3 ft. high and 15 or 20 ft. wide, could be spread over a width of 40 to 50 ft. and to a depth of less than a foot. It was found advantageous to leave at least five or six windrows at the outside of the storage area. These served as snow traps.

Clearing Intersection Area

No problem was found in clearing the wide intersection area, in storms accompanied by cross-winds. As described above, the plow passed through the intersection area on its straight run down each runway and at the end of the clearing job, the intersectional area was cleared. However, when the storm occurred with temperatures above freezing and with little or no wind, special problems were encountered in clearing.

When conditions of this type were encountered it was found practical to start operations on one runway, moving an equal amount of snow towards each side and at the end of each pass to make a pass around the outside of the intersection. By this method considerable snow was removed from the outside of the intersection by the time the first runway was cleared. In clearing the second runway the same procedure was followed. Thus, by the time the second runway was cleared, about half of the remaining snow in the intersection area had been removed. The remainder of the snow in the intersection area was removed while clearing the third runway.

Where two or three pieces of equipment are available they follow each other in echelon formation. In this way the plowing time is reduced in proportion to the number of units available. When more than three pieces of equipment are available it is usually best to divide them so that two or three parts of the field are being cleared simultaneously.

In planning removal operations before the arrival of the snow season, lines should be established well outside the edges of the hard surface runways, which form the boundaries of the area to be kept cleared. The area outside of and adjacent to these boundary lines is designated as permanent snow storage space. The area between the boundary lines and the hard-surface runways is considered as temporary or emergency snow storage space. This emergency space should be wide enough to accommodate the snow from two removal operations from the runways proper, in case two severe storms occur in rapid succession without allowing time between them for moving the snow to the permanent storage area.

Guiding Plow Through Storm

Since it is important to start operations early in the storm, the boundary lines should be conspicuously marked to guide the driver when visibility is low and when plowing at night. On the Clintonville airport the runways proper are 150 ft. wide and the width of the area to be kept clear of snow was arbitrarily set at 300 ft. This provided a permanent storage area of 100 ft. wide and a temporary storage area 75 ft. wide on either side of each runway.

The boundary lines of the 300-ft. cleared area were marked with flags on 5 ft. wood staffs. These were set in portable steel bases. On the top of each staff, above the flag, 5-in. diam. button-type amber reflectors were mounted. These markers were placed around the intersectional area on the intersections of the 300-ft. lines bounding the three runways, and along the outside of the runways. Markers were also placed on the 300-ft. lines and spaced about a thousand feet apart. With two 50-candle-power lights mounted on the top of the cabs and a manually operated spotlight, the drivers were able to follow a previously arranged pattern in a heavy snowstorm either in the day or night.

This new snow removal method, with large trucks pushing special plows at speeds of 25 mph., was found to be much more efficient and much faster than other methods. Ordinary highway displacement plows, either of the straight blade or V-type, were found completely unsatisfactory. Rotary plows were found to be much too slow.

New Snow Removal Method Summarized

It was found that many variations of the basic snow removal methods described above could be followed, depending on the shape of the field, the temperature and the wind direction, and the velocity and the amount of equipment available. However, 14 general rules applying to all variations of weather conditions have been laid down by the engineers.

1. The equipment must be suitable for airport work, not usually the case where highway plows are used.
2. Operations must be started early in the storm when less than 2 in. of snow has accumulated.
3. Snow must be moved in a direction which involves a minimum amount of plowing time.
4. High banks are to be avoided and can be avoided by a proper distribution of snow at boundary.
5. Snow deposited on the shoulders can be removed by the method described herein after the storm is over.
6. Where runways intersect, the intersection area should be completely cleared of snow.
7. The size and shape of the plow and the power of the truck should be such that the plowing can all be done at speeds of 25 mph. and faster.
8. At the beginning of the season, plowing should be carried on over all of the area on which plowing is contemplated, even when the snowfall is too light to interfere with traffic, to allow frost to penetrate and provide solid footing for equipment in later operations. This applies particularly to the shoulders of either side of paved runways, which should be maintained smooth enough to make high-speed plowing possible.
9. Snow should be kept moving constantly until it is finally deposited

(*Continued on page* 98)

Traffic Safety Program

Credited With Saving 6800 Lives in Year Since 1946 President's Conference

WHILE the highway engineer's final contribution to safer highway transportation is in the form of better roadway design and maintenance, he must of necessity broaden his interest to include other aspects of the appalling traffic accident problem. He must mesh into a complete national and state-wide concerted attack, spearheaded by leadership in local communities.

This, to our mind, is the chief message we can bring to ROADS AND STREETS readers from the President's Second Traffic Safety Conference, held under the general chairmanship of Maj. Gen. Philip B. Fleming, June 18-20 in Washington.

The highway engineer must cooperate with enforcement efforts, in which full cooperation is needed in the reporting, compiling and analyzing of accident data as an aid to eliminating danger spots and improving design.

He in turn is drawn into the educational side, where there is a grave necessity to learn more about driver habits and human behavior tendencies, as an aid to better roadway design and better sign and marker standards.

He should be interested, more than he now realizes, in his state's and cities' vehicle codes since they are the operating rules by which his product —the road—succeeds or fails as an efficient public service.

Highlights from President's 2nd Safety Meeting

- **Accident fatality rate down nationally from 11.3 to 9.8 per hundred million vehicle-miles in year's time—but still 33,500 deaths in 1946 with 1,200,000 injured and 1½ billion economic loss**
- **Rate in individual states continues to vary alarmingly—from 4.8 to 16.5**
- **Lowest accident rates achieved by states most faithful in following out the Conference action recommendations**
- **Laxity in state vehicle administration and local enforcement scored by President, who deplored continued tolerance of unfit drivers**
- **State-wide action programs—mobilizing all local organizations and applying all techniques of education, enforcement and engineering—seen as chief hope for continued reduction in accident rate**
- **Only half of states organized during year since first Conference, despite promises made by political bigshots who stood up in representation of their home-state governors**
- **Engineering action recommendations presented at the 1947 Conference are reported in detail below**

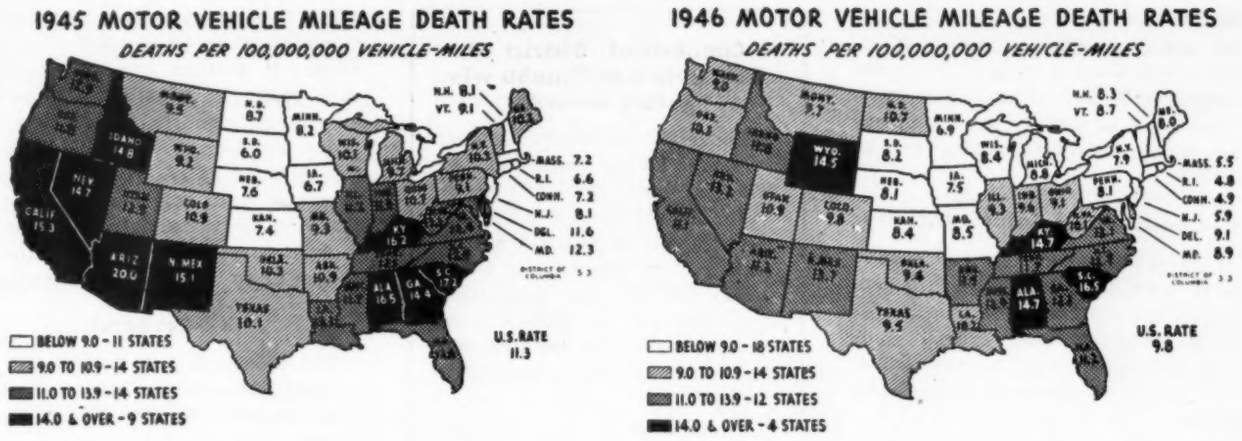
Splendid Start Made

Any lingering doubt of the value of a national safety action plan is dispelled in the dramatic summation made by Paul Hoffman at the close of the conference. Mr. Hoffman, who as chairman of the Automotive Safety Foundation and guiding spirit of other public service organizations, revealed that in the year since the first Conference this all-out national mobilization has helped bring the national traffic death rate from 11.3 down to 9.8 per hundred million vehicle-miles. This represents the saving of lives at an annual rate of 6,800 and the saving of hundreds of thousands of injuries and hundreds of millions in economic loss.

Reminding that this achievement represents only the easy third of the task, he warned against complacency and the inevitable tendency for early enthusiasm to fade. Confronted as we are with growing wholesale obsolescence of our streets and highways, and the rise of traffic to new volume peaks, all must intensify any action already initiated.

The lesson, said Mr. Hoffman, is clear. Those states which most faithfully carried out the action program laid down in 1946 are the ones which scored gains. Fourteen states had committees which applied all the specific recommendations. The 16 states with the poorest safety records, on the other hand, applied only about one-third of the recommendations. The Conference's aim for the coming yearly period is to patch the weak spots and particularly to see the formation of state-wide safety organizations in the 24 states which failed to so organize since the 1946 Conference.

While a third President's national conference was authorized to be held in 1948, if feasible, the Conference leaders believe that efforts from here on should be directed toward the holding of state conferences and state-wide mobilization of local organizations, Mr. Hoffman pointed out


1945 MOTOR VEHICLE MILEAGE DEATH RATES
DEATHS PER 100,000,000 VEHICLE-MILES
BELOW 9.0 - 11 STATES
9.0 TO 10.9 - 14 STATES
11.0 TO 13.9 - 14 STATES
14.0 & OVER - 9 STATES
U.S. RATE 11.3
1946 MOTOR VEHICLE MILEAGE DEATH RATES
DEATHS PER 100,000,000 VEHICLE-MILES
BELOW 9.0 - 18 STATES
9.0 TO 10.9 - 14 STATES
11.0 TO 13.9 - 12 STATES
14.0 & OVER - 4 STATES
U.S. RATE 9.8

that the poorest local support exists in states lacking strong state leadership. Safety work is weakest, in general, in urban areas. He scored state highway and state license officials in un-named states for continuing to feel that state safety organizations will be a political nuisance. In some states state-wide organizations must assume the leadership without their help and try to stimulate highway and vehicle administration officials to a new point of view.

"Travesty on Public Administration"

The dramatic high-spot of the Conference was the President's brief appearance. In a pithy statement he nailed state and local vehicle administrators and enforcement officials to a thousand front-page headlines as being laggards in the safety program. "We're dealing with a national disaster," he said, in which we continue to allow the dangerously unsafe and unfit to ride the highways. Congress won't stand idly by if this laxity continues, he warned in renewing his 1946 plea for a strong driver license program in the states and a uniform driving code over the country.

The President gave note to the fact that motor vehicles traveled 350 billion miles in this country in 1946—greatest in history and up 4% from 1941.

Heard were brief reports from these national committees organized from the 1946 Conference:

(1) The National Committee for Traffic Safety, composed currently of 80 national organizations having an active interest in the problem. The member organizations in this committee have a combined membership of more than 114 million men and women in 128,593 local clubs or units throughout the country. (W. Earl Hall, chairman.)

(2) The Federal Committee on Highway Safety, established by executive order to achieve closer coordination among agencies of the Federal Government concerned with highway safety, either in administrative capacity or as operators of motor vehicles. With 63,425 civilian cars, trucks and buses, in addition to Army, Navy, and Maritime Commission vehicles, the United States Government is the largest motor vehicle fleet operator in the world. (Maj. Gen. Fleming, chairman.)

(3) The State Officials' National Highway Safety Committee, bringing together for closer coordination on a nation-wide scale the associations representing the various state officials with jurisdiction in highway transportation. (Otto F. Messner, chairman).

Among the many other speakers was Judge Florence E. Allen, of Cleveland, who as vice chairman of the advisory group on law and ordinances, urged state centralization of information on local traffic ordinances and efforts to spur local adoption of the model traffic ordinance.

Engineering Action Steps

Recommended by Engineering Advisory Group at President's 2nd Safety Traffic Conference

Following summary is substantially as presented by Gibb Gilchrist, Chairman of the Engineering Advisory Group of the Conference, and President, Texas A & M College.

The Committee on Engineering at its organization meeting (March, 1946) divided its assigned problem into (1) General Aspects, (2) The Highway, (3) The Vehicle, (4) The Operation.

At the first Highway Safety Conference (May, 1946) the committee submitted with the Action Program 44 general recommendations [see R&S, June, 1946]. The report with its recommendations was adopted by the Conference and placed in the hands of all public and private agencies concerned or interested.

In line with the general policy of this conference no meeting of the full Committee on Engineering has subsequently been held, but, instead, an advisory group of nine from the committee, including one or more from each of the four main divisions, was asked to review the program and to submit further recommendations. The detailed report is printed in the 1947 Conference Progress Report, pp. 101-116.

The end of the war found many old roads and many old vehicles. Highway engineers found many such problems that could not be handled quickly, even though the solution might be apparent. Equally difficult was the dilemma of the vehicle designer and builder. The national emergency required the safest possible use of roads and of vehicles on hand and the replacement of wornout roads and vehicles with new designs and models within the shortest possible time. Shortages of labor and materials have been real limitations. These things take time and lots of it.

Taking these and other factors into consideration, the Advisory Group, while inviting further consideration of the recommendations adopted by

the 1946 conference, is directing certain specific suggestions to the attention of the several state highway departments. The detailed recommendations, eight in number, with supporting background information are as follows:

I.—Coordinated Safety Activity

County roads and city streets were developed independently until the decade of the thirties. Coordination in the planning and construction of highways and streets is the new trend, with safe transportation a main objective.

Some state highway departments are far advanced in their contacts with cities and with state and local planning and housing officials, police, educators and civic groups in the coordination of traffic safety work. Some departments conduct surveys and furnish advice upon request from the cities. In others the highway departments are restrained by law from aiding urban centers except in relation to state routes.

In New York state the new bureau of arterial route planning is working with 40 cities in the selection of express routes that will serve community and state to best advantage.

In many cities travel-habit studies sponsored by the highway departments and the PRA have served as stepping-stones to cooperative work with local officials. Aimed at safer use of existing improvements as well as development of new facilities, these studies enable the states to give cities effective aid in planning modern urban highway, street and parking facilities.

Lesser examples of state-city cooperation include investigations directed at problems in parking, intersection design and control, routing, signing, speed zoning, and one-way streets. The trend toward greater integration of the rural and urban phases of traffic safety has been given impetus by the Federal Highway Act of 1944. In this legislation, federal funds for construction of city expressways are made available for the first time. They are apportioned to the states for expenditure through the state highway departments. These departments are under obligation to administer the federal aid for cities to obtain maximum relief of the urban traffic problem. Wise administration requires adequate and mutually satisfactory working arrangements with the cities.

The joint achievements of state highway departments and other state and local groups in engineering for traffic safety are encouraging—yet they represent only a good beginning. State highway departments in general need to go much further in coordinating their highway safety work with that of state and local groups.

The Engineering Advisory Group recommends additional attention to the coordination of the highway safety work of state and local planning and housing officials, police, educators and civic groups. It recommends particularly that working contacts be maintained with one or more selected groups to determine by actual trial the value of this cooperative activity.

Connecticut, District of Columbia and Omaha win Safety Awards

The National Safety Council presented award plaques during the Conference to the following:

To The District of Columbia, the award in the Council's 1946 traffic safety contest, for being lowest in its city population class with only 59 traffic deaths, and for its record keeping, enforcement, education and engineering.

To Connecticut, for the best record in traffic safety for a state. Connecticut has won two firsts and four second places in six consecutive years, and its death rate on the highways today is only half the national average—a splendid example of what other states can do under able leadership.

To Omaha went first award for pedestrian safety, presented by Lee Holland of Kansas City in behalf of the American Automobile Association. To the D. of C. also a plaque for second place honors in the AAA's pedestrian safety contest.

II.—Summarization of Surveys

Highway planning surveys have been under way since 1935. All states now require the continuous collection of comprehensive and complete information concerning the character, extent, condition, and accident record of their road systems.

The next essential step is for all states to summarize the findings of their highway planning surveys. California has completed and Michigan has begun extensive and significant projects for the presentation of engineering data developed from the highway planning surveys. An account of the accident experience in these states is a part of their summaries.

The Group recommends that similar summarizations be completed in each state. It further recommends that each state draw up an appropriate long-range plan for future road improvement based on the summary of survey findings. A well planned and executed road program will remedy many of the defects in the existing highway system, principally through the use of up-to-date design standards.

III.—Research

Research is basic to progress in designing and building safer highways. State highway departments are recognizing this principle and their responsibility in applying it. They are seeing the value of research activity to their own personnel and of the specialized experience of their personnel to the general research program.

Under the Federal Highway Act of 1944 money is available for participation by the states in research and economic investigations of general value in highway safety activities. Fifteen states have joined in a cooperative study of the relation between highway design and frequency of traffic accidents on rural sections of principal routes. Known as the National Interstate Highway Accident Study, this research was sponsored by the Public Roads Administration and the National Safety Council. Other work of this character has been done.

State highway departments have supported the Highway Research Correlation Service established last year by the Highway Research Board of the National Research Council. To stimulate further highway department activity in traffic research, a specialist in traffic was added to the service staff early this year.

A considerable number of highway departments have set excellent examples in the field of research. In view of the extreme need for many additional investigations in the traffic and safety field, the Engineering Advisory Group recommends that every department undertake some phase of the national traffic research program. The Highway Research Correlation Service is serving as the clearing house for these activities and the 1½% of federal aid funds authorized for research and economic investigation is available for participation in projects of this nature.

IV.—Allocation of Grade Crossing Costs

The 1946 report of the Committee on Engineering outlined the steps that are essential to the protection of

highway-railway grade crossings. The complete protection is, of course, separation of grades.

The 1947 summary of progress in engineering indicates that the substantial prewar activity in the elimination of rail-highway grade crossings has now been resumed. In those cases where the separation of grades is not feasible, the report cites excellent progress in protecting crossings by the installation of standard protective devices.

The 1947 report also re-emphasizes that present state and local laws are not entirely equitable in respect to the appropriate division of the costs of crossing protection between railroad and highway.

The 1944 act established a formula for the equitable distribution between railway and highway interests of the cost of grade separation, reconstruction, and protection projects, based on relative benefits to road and rail transportation. Several states are following this example.

It is believed that an equitable allocation of the costs of crossing protection will accelerate the work of the states in protecting or eliminating grade crossings. The Engineering Advisory Group therefore recommends that those states which have not yet done so should consider the revision of their grade-crossing laws along the lines of the Federal Highway Act of 1944.

V.—On-the-Job Training

With the expansion of their forces since the end of the war, several state highway departments have been active in personnel training, particularly of returned servicemen. Some have sent staff members to traffic institutes. Others, such as Michigan and Utah, have emphasized on-the-job training. In these states, key department officials have led weekly or monthly seminars to acquaint employees with the activities of the department.

On-the-job training has produced particularly gratifying results. On the premise that improved quality in all branches of highway engineering eventually leads to safer highway design, construction and operation, the Engineering Advisory Group recommends that all states not already providing in-service training should consider establishing some form of training course.

VI.—Upward Revision Standards

In the advance planning of postwar highways, experience with the earlier highway design standards and new findings in traffic research were carefully reviewed. The results of the early part of this study appeared in the report of the Interregional Highway Committee.

The recommendations of the Interregional Committee in turn had a noticeable effect on the standards subsequently approved by AASHO for routes of the National Interstate System. These upward revisions in design standards have been widely adopted.

Other significant design changes applied by individual states:

Added lanes for trucks on grades and wider shoulders over crests with restricted sight distances, now established policy in Colorado.

New Jersey is emphasizing adequate signing in all features of layout and design.

Many states are paying more attention to intersection design and to channelization.

In process of development are provisions for added lanes and loading facilities for mass transit vehicles on urban expressways.

Marked progress in the design of modern high-speed highways is evident. The Engineering Advisory Group recommends that each highway department take full advantage of the services of the Highway Research Correlation Service, the Public Roads Administration, and their own interstate contacts to accumulate additional refinements in the standards of design of safe roadway facilities.

VII.—Controlled Access

Control of access is one of the most important safety elements for highways handling heavy traffic volume. Yet it is so new a concept in this country that it is still being tested in the courts as to its constitutionality. Frequently the only way for highway departments to use this type of improvement is to obtain legislation specifically authorizing it.

The policy of the highway department in California is to acquire access rights on practically all new construction. In several states, access control has been approved for one or more cities but not for state-wide application.

In states lacking access-control legislation, highway departments have adopted a policy of purchasing additional right-of-way width as substitute protection.

It is probable that this type of facility will ultimately be accepted universally. In view of its high value as a highway safety measure, the Engineering Advisory Group recommends that the long-term policy of all state highway departments should be directed toward eventual acceptance of the access-control type of highway construction.

VIII.—Accident Records

Certain locations often have more than their share of the accidents. If a state is to make substantial progress in its safety effort, it must be able to identify these high-accident locations promptly. This calls for an adequate accident reporting system. Progress in highway safety also demands a successful plan for study and treatment of dangerous locations.

In Utah and Virginia three accidents at one location put into operation a system involving a complete report, a detailed study, and a prescription for treatment if road conditions seem to be responsible for the accidents. Minnesota and a few other states follow a similar system.

Texas, Massachusetts and California use accident record information in their broad program of planning and programming construction and maintenance. Many states apply their accident experience in determining the effectiveness of traffic control devices and regulations as well as the design of the highway itself.

Highway departments not now having convenient access to reliable accident records should undertake to remedy this situation through whatever measures may seem most appropriate. The data will be especially valuable in prompt and systematic identification and treatment of high accident locations.

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Meetings Ahead

American Association of State Highway Officials—Annual convention, Waldorf-Astoria Hotel, New York, N. Y.; executive meeting, Sept. 21; general meeting, Sept. 22-26.

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Associated General Contractors of America, Inc.—29th Annual convention, Dallas, Texas, Feb. 9-12, 1948. (Fall meeting of governing and advisory boards, Des Moines, Sept. 29-Oct. 1.)

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Institute of Traffic Engineers—18th Annual meeting, Hotel Fort Shelby, Detroit, Mich.; Oct. 1-4.

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American Public Works Association—Annual Public Works Congress, Jacksonville, Fla.; George Washington Hotel, Oct. 6-8.

Crawler Tracks

Their Lubrication and Maintenance

Originally published in the Texas Company's magazine, "Lubrication," this article should be read as a refresher by every contractor, highway department or municipal employee charged with equipment care

By K. L. Hollister
and
E. V. Albert

Technical and Research Division
The Texas Company, New York 17, New York

THE track roller is the focal point of a machine equipped with a crawler track. Regardless of how efficient the engine may be, if the track roller mechanism fails the machine stops, or else wears the track roller pins so severely as to require replacement. No wonder the builders, the users, the lubrication engineers thought of lubrication as the cure and today regard track roller lubrication as probably the most important feature in their maintenance schedules.

Track rollers are separated from the ground only by the track itself. Due to their location, they have to work in mud, sand, water, ice and snow, and at the same time, carry the load of the entire machine for many years. This combination of load and wet abrasive operating conditions has presented a lubrication problem which has only recently been satisfactorily solved by the development of specially prepared track roll lubricants.

The crawler mechanism consists of a sprocket-driven endless chain formed by short sections of metal plates or track shoes hinged together. On the back of each track shoe are two short parallel rails which combine to form a track which runs on small wheels called variously track wheels, truck wheels, track rollers, crawler rollers, bogie wheels, etc. These are carried on plain sleeve type bearings or roller bearings.

Lubrication, Plain Bearing Type

The plain bearing track roller is an exceptionally well designed mechanism. It has to be to survive long under the severe conditions to which it is subjected. Its method of lubrication is simple, befitting its rugged construction. The lubricant is applied under air pressure from a 6/1 or a 10/1 ratio air pump or through a hand operated volume compressor. The lubricant is forced through a button-head grease fitting located at the end of the roller. From the drilled shaft, the lubricant is forced into a reservoir or cavity in the track roller bearing. From the reservoir, the lubricant flows through short passages to plain bronze bearings. Leather, composition or metal faced seals at each end of the shaft prevent leakage of the lubricant and keep out dirt.

Even though some very ingenious and effective types of seals are used, some foreign matter tends to work into the bearings, especially if operating in fine sand and water when rollers are worn or if seals are hardened or damaged. To counteract this tendency of dirt and water to work into the bearing, it is desirable to allow a seepage of lubricant.

Lubrication Must Be Right:

The problem has been to provide a water resistant lubricant which will be sufficiently fluid to flow through the lubricating passages keeping seals in good condition and counteracting the entrance of dirt and water, but not too fluid to leak excessively and allow the rollers to run dry between greasings.

Oil is satisfactory for new rollers, but is apt to leak excessively from worn rollers, especially on a hot day.

Grease, on the other hand, on a cool day may not flow sufficiently to keep out dirt and water so it may fail to keep the seals in good condition. Ordinary grease also is difficult to handle in the pumping equipment which is used for applying lubricant to the track rollers.

Buttery, semi-fluid chassis lubricants are a poor compromise. They tend to leak too much from worn rollers on warm days and are not sufficiently fluid on new rollers in cold weather.

The Necessary Characteristics:

Fluidity—The answer to this part of the lubricant problem is a stringy, tacky semi-fluid lubricant. This combination of characteristics in a lubricant is not easy to attain. The lubri-

cant should contain special ingredients that provide the desired combination of properties, i.e., ability to flow properly where clearances are small and yet not leak excessively from worn rollers due to an internal cohesiveness which will cause it to collect outside the seal and give added protection against the entrance of dust and water.

Water-repellence— A water-resistant lubricant provides most satisfactory lubrication under wet conditions by preventing the entrance of water which can cause rust and impairment of lubrication.

Pumpability—The lubricant must be easily pumped by the volume compressor which is usually used for the application of lubricant to track rollers.

Economy—A thoroughly satisfactory lubricant is required for an application such as this even though some leakage is desired and a considerable quantity of lubricant may be required to service a fleet. No product is cheap regardless of price under these conditions, if through its use the wear and replacement of parts is not kept to an economical minimum.

The Grades:

A modern track roll lubricant should be available in seasonal grades —Light, Medium and Heavy. The medium grade should be suited for normal atmosphere temperatures: 32-90°, the heavy grade for temperatures above 90°, and the light grade for temperatures below 32°.

Uses:

Track roll lubricants are recommended for all track rollers fitted with plain bearings. Where a track roll lubricant is of such nature that it can be used in all types of track rollers (except those running on roller bearings), the lubrication of machines on large construction projects is expedited where a variety of equipment is in service. A good track roll lubricant can be used in all plain track rollers, and is also well suited for all parts of the crawler mechanism requiring lubrication, including the front idler bearings and the outer sprocket shaft bearings. Such a lubricant is also widely used as a general purpose lubricant in cold weather for all plain bearings not subjected to external heat. No lubricant should ever be applied to the track shoe pins. The original stiffness in new tracks will soon disappear in service.

Frequency of Lubrication:

Manufacturers recommend that plain bearing track rollers be lubricated at intervals ranging from 2 to 120 operating hours, depending on type of lubricant, design of roller, condition of seals, nature of terrain and atmospheric temperature. When operating in water, the interval should be four hours or less. Shovels, draglines, cranes, etc., should be lubricated every two hours when traveling. However, most contractors prefer to lubricate each roller with the grease gun at least once each shift, since the men responsible for lubrication cannot always know the extent to which each roller is worn, the condition of the seals or what type of ground condition has been, or will be encountered. This can be done rather quickly when the machine is being fueled and other daily maintenance items checked.

Application of Lubricant:

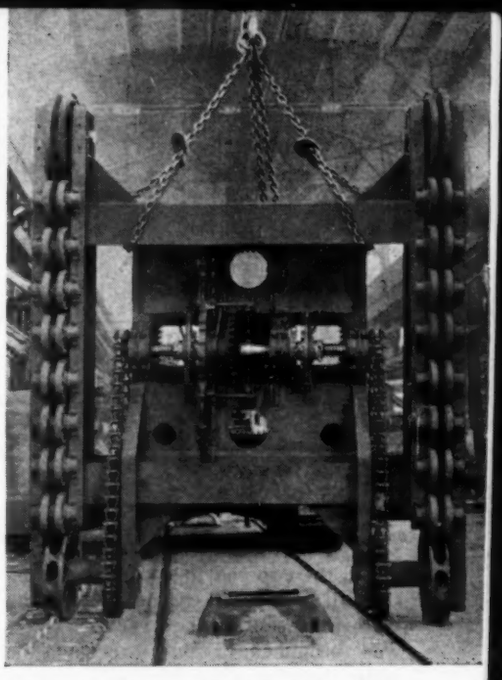
To lubricate plain bearing track rollers the button head or other type grease fitting should be thoroughly cleaned with a stiff brush. Better still, one of the special pocket tools which are available for cleaning dirt from the groove of the button-head fitting could be used so that the hose coupling can be quickly and easily attached. The tool also removes dirt from over the center inlet hole preventing this dirt being forced into the bearing. The oil hose connection from the bucket or other type pump should be hooked on to the track roller fitting. Lubricant should be pumped into each bearing until clean lubricant begins to show.

In applying lubricant, the first strokes of the gun will refill the reservoir while the following strokes push out the lubricant adjacent to the seals which has become contaminated with dirt or water. After the reservoir has been refilled, increased pressure will be required at the gun handle. If the ground conditions have not been bad, one extra stroke of the gun after the reservoir has been refilled should suffice. If the machines have been operating in mud and water or very fine sand, several extra strokes may be required before clean grease is visible at the roller shaft end or at the roller end collar. Too much pressure should not be applied to the lubricator handle or seals may be injured.

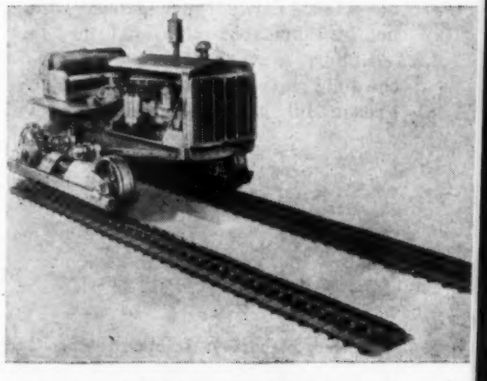
Roller Bearing Track Rollers

Roller bearings are used in truck wheels, idlers, and track rollers of Allis-Chalmers track-type tractors. These assemblies are provided with positive seals on either end for retention of lubricant in the bearing and exclusion of water and foreign matter.

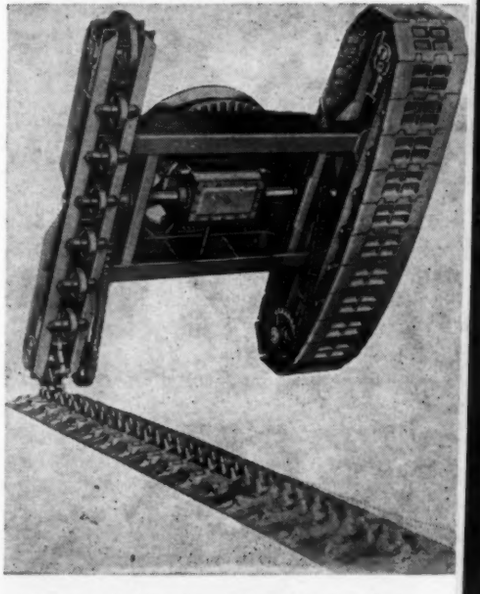
A quarter-view of a truck wheel employing roller bearings is shown in Fig. 8. Details of the assembly are illustrated, including the hollow inner



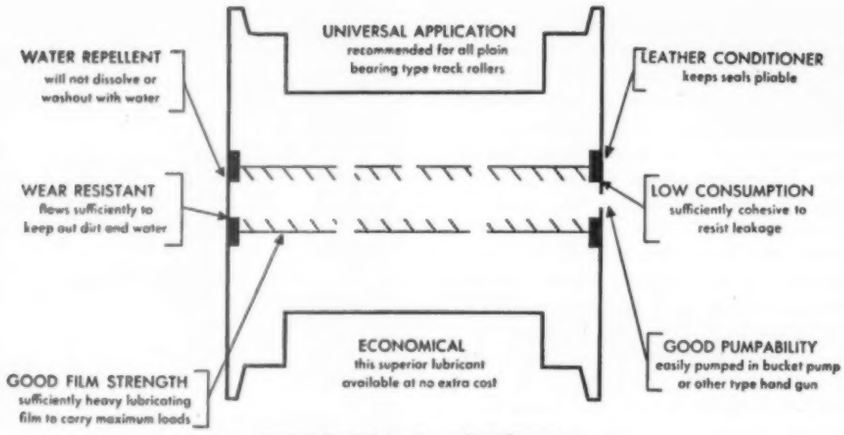
★ Fig. 1—Underneath view of the Link-Belt Speeder crawler mechanism with crawler treads removed. (Courtesy of Link Belt Speeder Corp.)



★ Fig. 2—The "Caterpillar" tractor with track removed. (Courtesy of Caterpillar Tractor Co.)



★ Fig. 3—External view of a Thew crawler mechanism. (Courtesy of The Thew Shovel Co.)


UNIVERSAL APPLICATION
recommended for all plain bearing type track rollers
WATER REPELLENT
will not dissolve or washout with water
LEATHER CONDITIONER
keeps seals pliable
WEAR RESISTANT
flows sufficiently to keep out dirt and water
LOW CONSUMPTION
sufficiently cohesive to resist leakage
ECONOMICAL
this superior lubricant available at no extra cost
GOOD PUMPABILITY
easily pumped in bucket pump or other type hand gun
GOOD FILM STRENGTH
sufficiently heavy lubricating film to carry maximum loads

Track Roller Lubricant — salient features.

shaft, the two bearings, and the seals.

Until recently, engine oil of the viscosity used in the tractor engine was recommended for lubricating the roller bearing type of truck wheels. To increase the length of time between service periods, however, these assemblies are now packed with grease at the factory. Assemblies that have been packed with grease should not be lubricated with oil later.

Rollers that are being operated in the field with oil can be converted to grease lubrication without removal from the tractor, providing they are in good mechanical condition. Operators who prefer oil may continue to use it with assemblies that originally contained oil. If oil is used, a lubrication interval of 200 hours is recommended.

Grease-packed assemblies should be relubricated at 1000-hour intervals. The type of grease recommended for these bearings was selected because of its good heat and oxidation stability, good pumpability and cold temperature characteristics, and for minimum effect on the synthetic rubber boots of the lubricant seals.

The properties of heat and oxidation stability are extremely important; it has been no small task to incorporate them in lime soap greases.

Greases most completely meeting the above requirements are calcium or lime soap base products, although some barium, aluminum or lithium soap greases might also be found satisfactory. A worked penetration range (ASTM) of 255 to 385 at 77° F. is recommended, with the viscosity of the mineral oil component specified as 120 to 185 S. U. seconds at 130° F. Fillers are undesirable as holds true for all anti-friction bearing lubrication.

Grease Packing in the Field:

Before packing with grease in the field, the operator should make certain that roller assemblies are in good condition and that there is no excessive oil leakage. The assembly should be inspected for end play and looseness. To inspect the truck wheels it is necessary to take the weight of the tractor off of them. Check each truck wheel, support roller and idler separately. If end play or up and down motion is present the assembly should be removed and repaired before serious damage or complete failure occurs. *Packing an assembly with grease will not correct worn or broken parts.*

A special nozzle assembly is supplied by the tractor manufacturer for use with either a lever grease gun or volume lubricator. The procedure recommended by the manufacturer is as follows:

"Clean the nozzle tube thoroughly and attach it to the coupler. Remove the plug from the end of the assembly to be packed. Remove dust cap from the end of nozzle and insert it full depth into the shaft of the assembly to be packed and hold in that position. Pump slowly until all the old lubricant is removed and new grease can be seen coming out along the outside of the nozzle.

Caution:

"Pump grease slowly and *do not* use an air powered lubrication system. Pumping the grease too fast will force open the seals and damage to the seal assemblies may result.

"Assemblies which have been packed with grease should never be lubricated later on with lubricating oil.

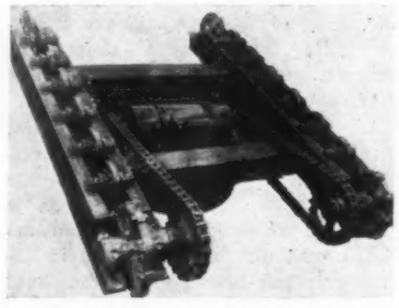
"Every 1000 hours of operation, relubricate the assemblies with a grease approved by the manufacturer. To repack proceed as outlined above and fill until new grease appears along the outside of the nozzle. It

(Courtesy of Buckeye Traction Ditcher Co.)

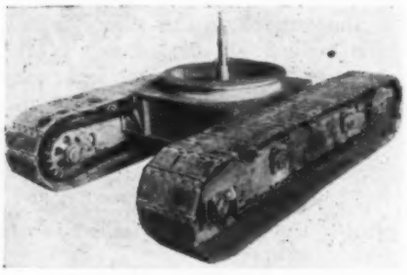
(Courtesy of Insley Manufacturing Corp.)

(Courtesy of The General Excavator Co.)

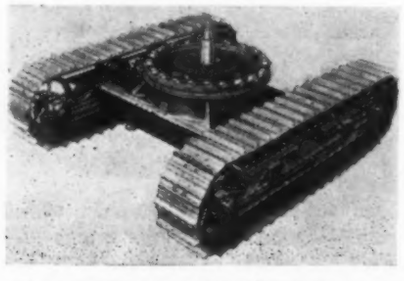
(Courtesy of The Osgood Company)



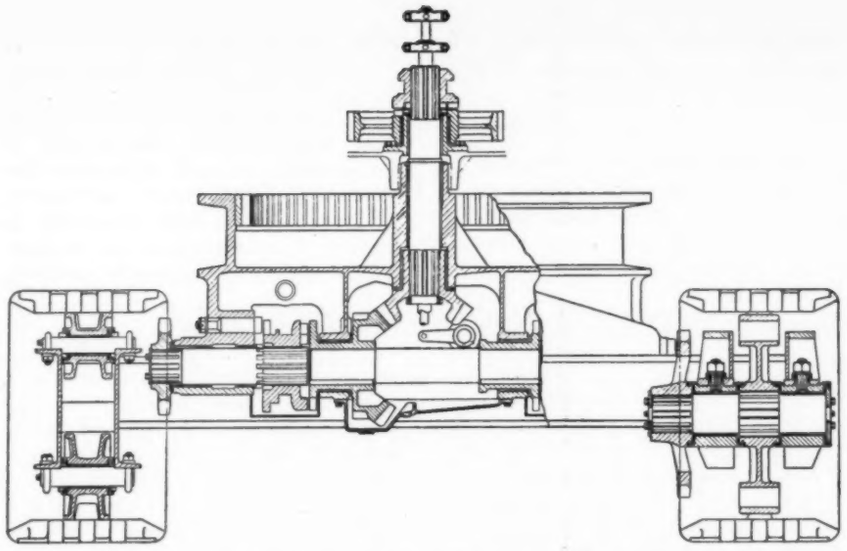
(Courtesy of Bucyrus-Erie Co.)



(Courtesy of Koehring Company)



(Courtesy of Harnischfeger Corp.)



★ Fig. 4—Cross section of a Lima track roller. (Courtesy of Lima Locomotive Works, Inc.)

is recommended that the grease and grease gun be at normal room temperature at 70° F. or above when filling the assemblies, as at such temperatures the grease will flow better to all parts.

Inspection:

"Every 1000 hours of operation, inspect the truck wheels, track idlers and support rollers for end play and up and down motion. To inspect the truck wheels it is necessary to take the weight of the tractor off of them. If any looseness or damage is noticed the assembly should be removed and repaired before serious damage or complete failure results."

Compliance with the above instructions of the tractor manufacturer results in improved operation and reduced maintenance, the true objectives of lubrication. The quantity of grease that is required for complete lubrication of the rollers on a tractor, varying from 12 to 28½ lbs. according to the size of the tractor, is but a small factor when compared with the increased maintenance period and protection of roller mechanisms thus afforded.

Servicing the Crawler Mechanism

As wear occurs at the track pins, bushings, rollers, idlers, and sprockets, the track becomes loose and the front idler has to be moved forward to take up the slack. For minimum wear, the track adjustment should be such that the track can be lifted with a bar 1½ to 2 inches above the upper track rollers. To make sure all the slack is in the upper portion of the track, place a 12-inch block under one of the forward track shoe lugs; put machine in low gear and engage clutch only enough so that rear sprocket tightens the track along the ground.

The track rollers, sprocket, and idler must be kept in alignment. The track frame must be aligned on the drive sprocket shaft using washers of the proper thickness so that the tracks travel true with the rollers. Shims are provided on the track front idler yoke to keep the front idler aligned properly.

Every 500 hours the nuts and bolts on the track crawler mechanism should be tightened; particularly the sprocket nuts and the bolts that hold the track roller assemblies to the track frame.

When installing a track roller on its shaft, be careful not to damage the seals.

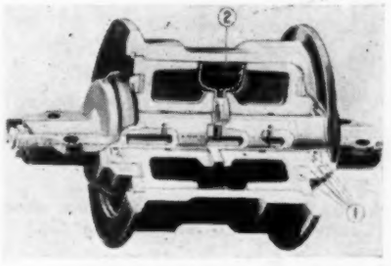
While the track roller is a simple rugged mechanism, it is probably more subject to wear than any other lubricated part on construction machinery and, therefore, must be given a certain amount of care. Most cases of undue wear are due to failure to apply the right lubricant at the right time.

Signs of Difficulty:

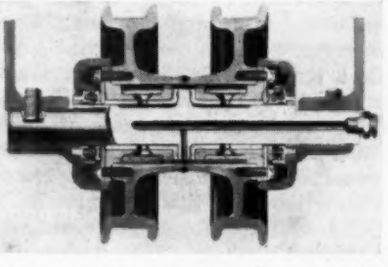
1. Rapid wear of one flange of roller—usually due to misalignment of idler or sprocket with rollers—realign.
2. Roller runs hot—usually due to misalignment or lack of lubricant—may have been missed at last lubrication period.
3. Excessive amount of lubricant required—if roller is not running hot, this is usually due to defective seals—replace.
4. Roller does not revolve in service—usually due to insufficient end of shaft clearance—check.
5. Roller flanges cutting into crawler frames—usually due to worn thrust washers—replace.
6. Track tends to climb sprocket—indicates track too loose—adjust tension.
7. Oil leaking at sprocket shaft nut—usually indicates loose spocket—tighten sprocket bearing adjusting nut.

Conclusion

To understand the theory of lubrication and to appreciate those factors which determine the relative lubricating value of any lubricant is commendable; to be able to put this knowledge into practice signifies that the machine requirements are quite as fully understood. Today, the operator of contracting machinery has such an understanding; he has graduated from the status of a lever-pusher, appreciative of the financial responsibility imposed upon him. His success is measured by yardage of



★ Fig. 5—The International Harvester track roller. (Courtesy of International Harvester Co., Inc.)



★ Fig. 6—The "Caterpillar" track roller. (Courtesy of Caterpillar Tractor Co.)

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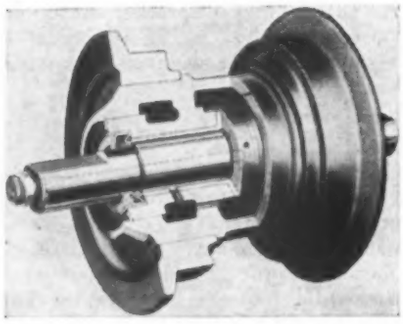
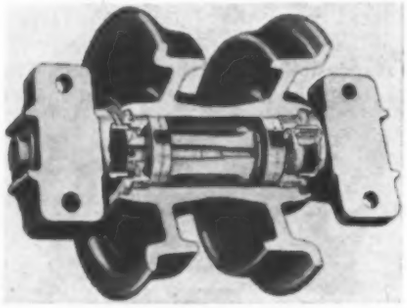
materials handled, by ability to meet contract dates, and by the cost of up-keep or maintenance of his equipment.



★ Fig. 7—The Oliver track wheel. (Courtesy of The Oliver Corporation)



★ Fig. 8—The Allis-Chalmers truck wheel. (Courtesy of Allis-Chalmers Mfg. Co.)

This latter is definitely associated with the theory of lubrication; the more effectively it is put into practice, the better the protection of the working elements. In applying any theory, however, one must consider the practical requirements—in the contracting field, the operating conditions. In other words, certain grades of lubricants should function satisfactorily on certain mechanisms. The operator knows, however, that this premise is based on laboratory procedure, or controlled testing. Subjected to the rains of the Ohio or Mississippi Valleys, the sleet of the Lakes Region, or the dust of the wheat belt, such lubricants might tell an entirely different story.

So the operator should not be content with lubricants capable of functioning satisfactorily on more protected machinery. He must take into account the exposed nature of his shovels, draglines, bulldozers, etc., and the extent to which the construction of their moving parts may be conducive to contamination of the lubricants. Water is especially detrimental. Wherever it is present in any appreciable amount it will tend to wash off certain types of lubricating films, if these latter have not been formed by lubricants especially refined and prepared to resist this washing action. Special track roll lubricants now available give the protection which is so necessary.

The right track roller lubricant keeps rollers rolling; keeps crawlers crawling; keeps shovels shoveling; keeps earth movers moving; keeps contractors contracting.

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(*Continued from page* 85)

the strength of the subgrade. It is to be expected that the subgrade soils directly under the approximate curb line will also utilize some of the reserve strength in the surrounding soil under the interior sections in any case of threatened overstressing. Attention is invited to the fact that here again no increase in slab strength due to the existence of the curb or of interior reinforcing steel was considered in the analysis.

Remarks on Method of Determining K-Value and Design Methods

It is interesting to note that subsequent tests of subgrade and base course materials by means of triaxial compression apparatus and calculations of K-value from such tests and elastic theory, have given results agreeing quite closely with those obtained by means of procedure outlined above. Hence, the selection of a method of determining K-value for concrete pavement in any particular case in advance of construction will be governed by consideration of convenience and effort involved in each method. Actual loading tests in the field are no doubt the most reliable source of information, and while such tests could not conveniently be arranged previously, it is planned to conduct a large number of these during construction.

In the same manner, design procedures are continually being reviewed and basic design data checked in every way possible, with a view to maintaining a design procedure current with the latest information available, and effecting economies in design whenever possible without loss of quality in the finished product.

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(*Continued from page* 89)

in the permanent storage area. If allowed to remain in the temporary storage area too long, thawing, freezing and settling will make it more difficult and costly to move.

10. Four-wheel drive trucks of 125 hp. or more are necessary to develop the necessary speed and traction.

11. Trucks should be equipped with single snow-tread tires front and rear, and ballasted to have the same weight on the front and rear axles, with the weight of the plow resting on the shoes.

12. A full complement of fully equipped trucks should be kept in readiness at all times through the snow season for exclusive use on the airport, with drivers available for day or night work. Where street or highway drivers are depended on, it has been found that they are busy at their regular work at the very time when they are needed most urgently for airport work.

13. On fields where air traffic is heavy, trucks should be provided with radio receivers or other signaling devices so that their movements can be directed from the control tower.

14. A plan must be prepared well in advance of the snow season and personnel carefully supervised and thoroughly trained to follow airport procedures, which are often considerably different from highway procedures to which they may be accustomed.

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(6) Woolson, Proc. ASTM, 1907, Page 404.

(7) "Road Design Circular No. 1-43-subject: Thickness of Flexible Base," D. C. Greer, State Highway Engineer, Texas Highway Department, Austin, Texas.

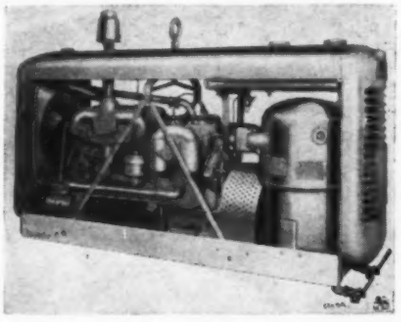
Note: Abbreviation "THD" used in text refers to "Texas Highway Department."

New Construction Equipment and Materials

1

New Air Compressor

A new "Airmaster" compressor, the "105" Utility, has been announced by Le Roi Co., Milwaukee, Wis. Entirely self contained and light in weight (1700 lb.), it has been specifically designed for either back of cab or on the platform of utility trucks. Floor area required is only 82 x 25 in. The engine used is the Le Roi D226, featuring replaceable cylinder sleeves,



The "105" Utility Compressor

precision bearings, overhead valves, pressure lubrication, and magneto ignition. The liquid cooled compressor is built integrally into the engine block and also has replaceable cylinder sleeves and precision bearings. The cylinder head and valves are identical to those employed in Le Roi Airmaster compressors. The new utility compressor is regulated by the Le Roi patented Econotrol governing compressor capacity automatically according to the demand for air. A lifting bail, 6-volt electric starting system, and the exclusive electric hourmeter on a centralized control panel are all supplied as standard equipment.

2

New Slide Rule

An improved Deci slide rule on which log scales are included has been brought out by Burrell Technical Supply Co., Pittsburgh, Pa. Features include: The Log Log scales all refer to a single D scale and have a greater range of direct reading (10^{-10} to 10^{10}). Powers (including those of base e) with both positive and negative exponents can be read with one setting of the hairline. Reciprocals can be read with the decimal point placed. Square root scale is double the length of the C scale. Cube root scale is triple the length of the C scale. The extra tangent scale is for angles from 45° to 84.3°. Exponential equations in which the unknown exponent is a negative number are easily solved without transferring readings from one scale to another.

3

Portable Saws

New features and design improvements have been incorporated in the line of portable engine-driven C-saws of Harry A. Lowther Co., Chicago, Ill.

Lowther Portable Saw

Two of the most important design innovations are the "Rototrac" self-propelling feature and an automatic, mercury-type C-Saw clutch. Both of these features will be incorporated on the new model 100 C-Saw. Rototrac self-propelling is a simplified friction drive that operates from the engine shaft. The new automatic C-Saw clutch is mercury filled fluid and centrifugal action type. The clutch automatically engages when the throttle is open and disengages instantly when the throttle is closed or if saw blade pinches. 1947 Lowther C-Saw models include the Model 100, equipped with "Rototrac" propelling and clutch; the Model 200, equipped with clutch; and Model 300 less clutch and power drive; and Model 400 which is a light duty 4 h.p. unit with automatic clutch, designed for clearing work.

Mail Inserted Card

For data on equipment described on these pages. See also inquiry blank on page 112.

4

Pick-Up Dump

A pick-up size dump body with completely automatic hydraulic cab control, introduced by the National Truck Equipment Co., Waukesha, Wis., is designed for multiple uses in short hauls and small bulk handling by contractors, builders, municipalities, etc, etc. Easily adaptable to almost every make and body style of pick-up in the ½, ¾ and 1-ton ratings, the pick-up dump is available either as a complete unit with dump body or as a kit for the conversion

Pick-Up Dump

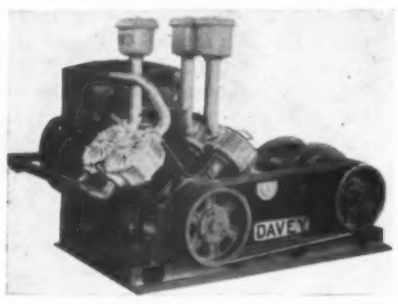
of practically all standard pick-ups into pick-up dumps. Included in the conversion kit are the power-pack (or hydraulic pump), hoist and subframe, hose and connecting parts, parts necessary to convert the standard tailgate into a double-acting tailgate, and the body sub-frame. The power pack is cab-controlled by a fingertip

lever mounted on the dashboard. The hydraulic hoist raises the body to the proper angle with a full 17-in. stroke and is hydraulically actuated by the power pack operated off the fan belt. Of welded construction, the pick-up dump body incorporates the use of heavy gauge steel for sides, ends and bottom, which in turn is supported by channels and angles.

5

New Air Compressors

A complete new line of 2-stage, air-cooled industrial air compressors of 60, 105, 160, 210 and 315 c.f.m. capacities has been announced by Davey Compression Co., Kent, O. Known as "Air Chief Industrials," these machines feature Permanent Peak Efficiency Valves and the new Davey Equi-Balanced crankshaft. The machines are available in four types:



Air Chief Compressor

(1) Base Compressors, (2) Stationary units with base ready for installation of customer's electrical equipment, (3) Departmental Compressors powered by A. C. motors, (4) Departmental Compressors with D. C. motors.

6

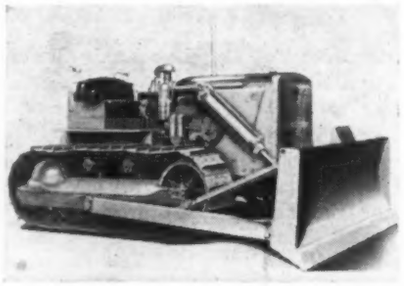
New Highway Lighting Fixture

A new Holophane prismatic globe, claimed to be the largest bowl refractor ever produced, has been announced by the Lighting Division of the General Electric Co., Schenectady, N. Y. Combined with G-E's Form 79 and Form 101 casings and reflectors, it is stated the globe will place as much as 43% more light on the street than the best reflector-type luminaire now available. The new luminaire will be particularly applicable to freeways, urban highways, boulevards, main traffic arteries, and secondary business streets. Factors in its usual application will be: minimum street width of 60 ft. the need for large-size lamps, the desirability of 0.8 footcandles or more, and the economies of maximum spacing. The prismatic globe will accommodate 10,000- or 15,000-lumen filament lamps or a 16,000-lumen mercury lamp.

7

New Hydraulic Controlled Bulldozers

Four sizes of hydraulic controlled bulldozers have been added to the line of earth moving products of Caterpillar Tractor Co., Peoria, Ill. The new bulldozers are designed exclusively for use with "Caterpillar" Diesel D8, D7, D6 and D4 track-type tractors. They are offered in addition to "Caterpillar" cable controlled bulldozers for the D8, D7 and D6 models. The hydraulic controlled bulldozers are similar in design to the cable controlled bulldozers. Features of the "Caterpillar" hydraulic system, as outlined by the manufacturer: Front mounted, positive action, balanced vane pump, integral with tank and operating valves. Manually operated 3-position valve with "raise," "lower" and "hold" positions. Interior steel surfaces of the entire system given non-corrosive Parco-lubrite treatment for maximum operating efficiency and wear resistance. Pins connecting the pistons and push arms carburized to provide long life. Rapid blade action offering blade adjustments to meet varying work conditions. Heavy steel guard protecting front-mounted hydraulic pump housing.



"Caterpillar" No. 7S Straight Type Hydraulic Controlled Bulldozer

8

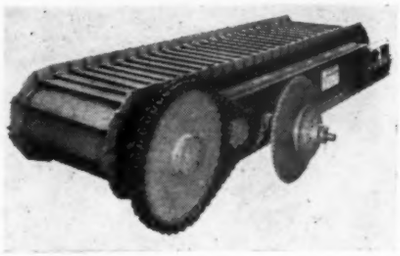
New Jackbit

A new stud-type jackbit added to the line of rock drilling equipment of Ingersoll-Rand Co., New York, N. Y., has an attachment member, designated as the jackstud. The bit has new, carefully worked out wing curves stated to enable it to retain new bit proportions through many resharpenings. The resulting small gage loss is claimed to permit using successive bits with reductions in diameter of 1/16-in. or less per change. This makes it possible to start holes with smaller bits than those previously used and still bottom them at the same size as before. The stud jackbit system is the result of extensive and field research to develop an improved detachable bit and connection wherein the bit, rod and attachment medium would be designed and manufactured from materials best suited for the functions peculiar to each. The jackstud, which connects the bit to the drill rod, is made of high-grade, carburized alloy steel selected to withstand this service.

9

New Feeder

Designed to meet the high-capacity, long-distance feeding problem of a Pacific Coast contractor handling railroad ballast a new feeder has been produced by Lippmann Engineering Works, Milwaukee, Wis. The first unit was 35 ft. long, and it is stated operating tests show that any reasonable length can be built. Pictured is one of the shorter length super-duty feeders. High strength is claimed to be achieved because the endless conveyor is fabricated of cast steel plates, hinged together with heat-treated alloy steel pins. The plates are reinforced with ribs to withstand severe impact. These plates move on heat-treated high carbon steel rollers over sprockets on each side. The rollers, in turn, revolve on an abrasion resistant steel track. Anti-friction bearings are used throughout, and the ruggedness of the feeder is keynoted by the 18 in. deep, wide-flanged beams that constitute the main frame.



Super-Duty Feeder

10

Check for Oil Contamination

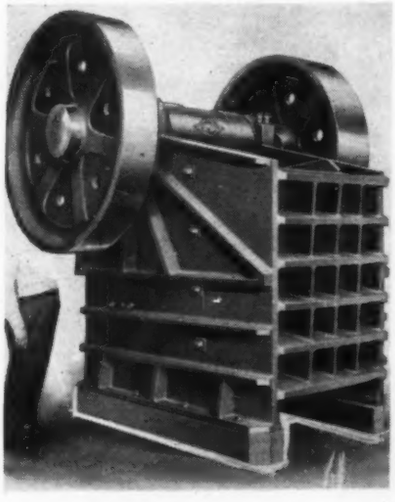
The Claroblot, a simple but effective tool for showing the exact amount of contamination in lubricating oil, has been developed by W. G. B. Oil Clarifier, Inc., Kingston, N. Y. It is a result of several years of research work by the W.G.B. engineering department to give the car or truck operator a simple but effective way to determine oil or cartridge change pepiods. It is intended to keep the op-

erator conscious of his oil condition so that he will service his oil clarifier promptly, and thus keep his engines in peak operating efficiency with a minimum of maintenance expense. A suggested use is: By fleets to keep lurbication records. Many small fleets keep their entire lubrication record on a given vehicle on a Claroblot, marking down the engine miles, filter and oil change mileages along with a permanent record of the oil condition at all times.

11

New Jaw Crusher

A new larger size jaw crusher, the 36x48, has been added to the line of Diamond Iron Works, Inc., Minneapolis, Minn. With main frames of welded structural plate, reinforced with heavy ribs, the new unit is stated to have a capacity range of 130 to 500 tons per hour. The Diamond jaw crusher is of the overhead eccentric



36x48 Jaw Crusher

type, with cast reversible, manganese steel jaws, and oversize roller bearings. The balanced flywheels are finished for either flat or V-belt drive. Adjustments for product size can be made while crusher is in operation. Grease lubrication, sealed against dirt and grit, is provided in all Diamond design, with housings packed before shipment. Stationary and movable jaw lengths are 74¼ in. and 83¾ in. respectively. Shipping weight is 85,000 lb.

12

New ¾-Cu. Yd. Machine

A new ¾ cu. yd. machine, the 33-M has been announced by Marion Power Shovel Co., Marion, O. With various front-end combinations, it is a shovel, dragline, clamshell, crane and backhoe. Features claimed for the new

The W-W 10-15 Ton Low Bed

Springless low-bed full trailer type

This type light trailer has been found most versatile by construction companies, State and County highway departments and for heavy hauling contractors.

Weighing only 6400 pounds, it provides easy pull, yet it is so strongly constructed, so sturdily built, it takes loads up to 15 tons with ease.

If your heavy hauling problem seldom exceeds the 15-ton limit, this W-W Low-bed is the answer. If you need a trailer with 20 to 60 ton capacity Winter-Weiss has the answer for that too.

Immediate Delivery on any standard 10-15, 20 to 40 ton semi or full trailer types.

Coupon brings pictures, specifications on any type low bed desired. Simply attach to your letterhead and mail today.

Mail today

The WINTER-WEISS Co.
22nd & Blake Sts. Denver 2, Colorado

Gentlemen: Please send me complete information on W-W Low Bed machinery trailers. We are particularly interested in a .....ton capacity model.

Firm Name.....
Address.....
City.....Zone.....State.....
By.....Title.....

machine include Marion air control, a greatly simplified machinery deck with only two shafts across the deck, simple changeovers for front-end equipment, the use of 22 ball and roller bearings. Only 12 gears are used in the entire machine. Conversion of the front-end does not require any changes of drum lagging, sprockets, levers, etc. The same drums are

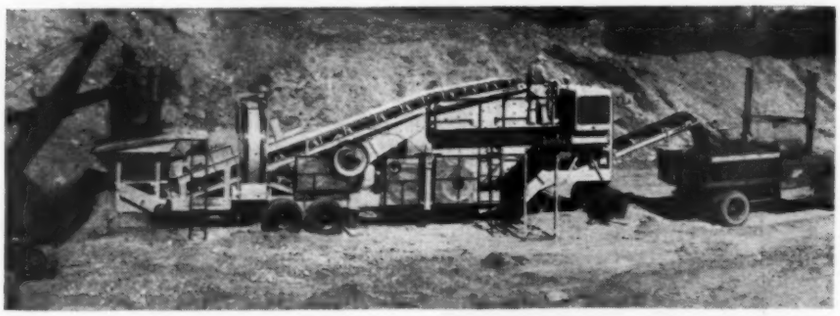
Marion 33-M ¾-yd. Shovel

used on all combinations. The shovel boom also serves as the boom for the backhoe. The crane boom point is adaptable without change for crane, clamshell, dragline and pile driver service. Crawler pads and crawler rollers are forged, and the rollers are shielded from dirt. The lower frame design makes use of both castings and welded plates. Two steering and propel brakes are 20 in. in diameter and the hoist and crowd brakes are 31 in. in diameter. The swing brake, on the main rotating shaft, is of the "Vee block" type. Marion air control covers all digging motions, gear changes and the operation of the steering clutches, propel brake, swing brake, dipper trip and engine clutch. A maximum of 12 lb. pressure operates any air control lever. Dual crowd, a combination of dependent and independent crowd, is standard, as is an independent high-speed boom hoist. The new 33-M is the smallest machine in the Marion line, other sizes ranging up to 40 cubic yards.

13

New Portable Gravel Plant

A new 3-stage portable gravel plant has been announced by Universal Engineering Corporation, Cedar Rapids, Ia. This new portable crushing, screening and loading plant features the Twin Dual roll crusher, an exclusive, patented Universal development. Its use provides three stages of crushing in a single-unit portable plant. The Twin Dual roll crusher is a two stage secondary crusher in one machine. It consists of two sets of different diameter rolls mounted on common roll shafts and operating simultaneously. The primary crusher is a 10 in. x 24 in. roller bearing Streamline jams crusher, and the twin secondary is a 24-in. roller bearing star gear Twin Dual roll crusher. The 3 ft. x 10 ft. 3½-deck roller bearing gyrating screen is mounted on an incline and gives exceptionally rapid gradation of material. Thirty-in. conveyors are used to handle the in-



Twin-Dual Master Portable Crushing, Screening and Loading Plant

Welded Construction

MAKES A BIG DIFFERENCE...

WELLMAN

Williams Type BUCKETS

• Wellman leads the field in welded bucket construction. Wellman improved design means *better service, lower cost for you!* A type for every purpose: Multiple Rope, Power Arm, Dragline, Power Wheel, Special Service: ⅜ to 16½-yd. capacity.

SEND FOR BULLETIN

THE WELLMAN ENGINEERING COMPANY
7003 CENTRAL AVENUE • CLEVELAND 4, OHIO

creased capacity and are equipped with anti-friction bearings; troughing rolls are equipped with sealed-for-life bearings. A large capacity revolving elevator (Rotovator) eliminates complex return conveyor system and shortens overall length. The gooseneck truck is of 12-in. channel frame construction and is equipped with 12 pneumatic tires with equalizers on rear wheels. Air brakes are standard equipment.

Without power the new Twin Dual Master weighs 47,820 lb. Moving height and operating height is 12' 6". Moving length 46 ft. overall; width 8 ft.

14

New Line Marker

A new line marker for making street crossings, parking spaces, dividing lines and intersections on city streets and highways has been placed on the market by Newaygo Engineering Co., Newago, Mich. The line marker is a simple, foolproof unit. It has no spray nozzles, pumps or hose.

Newaygo Line Marker

The painting liquid is held at a fixed level in the reservoir in front of the paint tank by vacuum. From here the paint is picked up by an idler wheel, which dips into it and spreads the paint onto the marking wheel, which in turn rolls the paint evenly on the street surface.

15

New Tractor Set

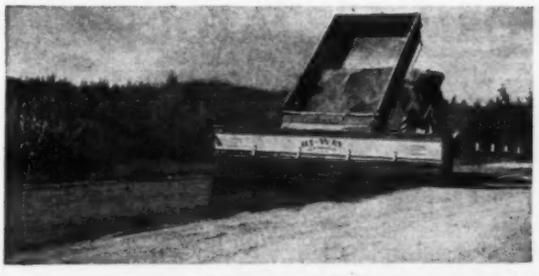
A new set of pullers, developed especially for Massey-Harris tractors, has been announced by the Owatonna Tool Co., Owatonna, Minn. This set will accomplish a majority of the removal and installation operations involving gears, bearings, bearing outer races, pinions, couplings, sleeves,

EVERY DAY
A WORKING DAY

THE VERSATILE HIGHWAY MODEL "E"

Here is the four-way answer to street and highway problems. The new *Highway Model "E" Spreader* can be used for positive ice control in winter, dust control with calcium chloride in summer, for spreading seal coats on oil, and, by removing the distributor disc it is ideal for spreading small rock and chips for shoulder maintenance. When operating as an ice control unit, the *Model "E"* casts sand or cinders *low* to the highway, eliminating interference with traffic. Material is spread ahead of rear wheels of truck providing traction for truck and *safety* at any operating speed. It will cover the full width of a 2 or 4-lane highway in one operation. All controls are within easy reach of the driver's seat making the Model "E" a labor saving, one-man unit. Furnished in four lengths to fit any truck chassis. Write for complete details.

For More Profitable Material Spreading—THE HIGHWAY MODEL 'R'



AVAILABLE IN SIZES FROM
8 TO 13 FOOT WIDTHS.

COMPARE THESE TIME AND MATERIAL SAVING FEATURES

- Smooth spreading—no thick and thin spots. Spiral feed roller with agitator-conveyor provides fast even spread. Adjustable feed gate controls thickness. Width is adjustable from one foot to full width of spreader.
- Reversible transmissions permit forward or reverse motion simply by shifting lever.
- Swivel type self-coupling adjustable hitch allows traction wheels to remain in constant contact with ground regardless of position of truck or spreader. Entire unit is balanced for easy hook-up to truck.

Write for complete details

SOLD AND DISTRIBUTED BY LEADING CONSTRUCTION EQUIPMENT DEALERS THROUGHOUT THE UNITED STATES, CANADA, AND FOREIGN COUNTRIES

HIGHWAY EQUIPMENT COMPANY, INC.
605 D AVENUE N. W. • CEDAR RAPIDS, IOWA

MANUFACTURERS OF THE WORLD'S MOST COMPLETE LINE OF SPREADERS

This 2½ cu. yd. Sauerman Power Scraper cuts deeply into hill of gravel and moves about 85 cu. yd. of material an hour to crusher. The scraper tail-block is attached to a movable A-frame located on the brow of the hill.

☆

Great Flexibility

Sauerman machine can reach across a stream, pond, pit or stockpile or to top of hill and move material rapidly from any point within its cable radius. The radius can be extended as far as 1,000 ft. or more.

☆

Write for Catalog

Completely illustrated book describing many typical installations sent on request. Our Engineering Department will gladly advise on your own problems.

☆

SAUERMAN POWER SCRAPERS

With a Sauerman Power Scraper you can simplify many excavating and stockpiling jobs that involve moving materials short distances. A Sauerman machine digs a heaping load, hauls this load to any desired point within its operating radius, dumps automaticaly, then returns at high speed to dig another load. Bucket capacities run from 1/4 to 15 cu. yds.

Operation and Upkeep Are Simple . . .

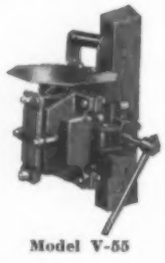
The operator of a Sauerman Scraper has control of everything at his finger-tips. Any workman is easily trained for the job. Power consumption is small. Installation and upkeep costs are surprisingly low.

SAUERMAN BROS., INC. 588 S. CLINTON STREET CHICAGO 7, ILLINOIS

SYNTRON
REG. TRADE MARK
"Pulsating Electromagnet"

CONCRETE FORM VIBRATORS

with quick-acting vise clamp



Model V-55

Model V-75

SPEED UP PLACING AND SETTING

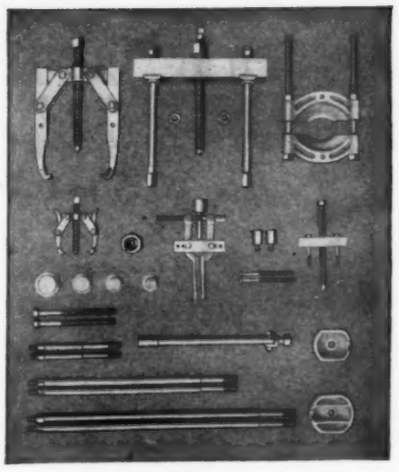
3,600 powerful, pulsating vibrations per minute eliminate hand rodding and spading—flow concrete into difficult, hard-to-get-at places—eliminate voids and pockets.

Applied to thin wall forms, pipe forms, etc.

Write for catalog folder.

SYNTRON CO.

384 Lexington, Homer City, Pa.



Pullers for Massey-Harris Tractors

shafts and other close-fitting parts, and do these jobs quickly and easily without damage to the parts. The set was developed in cooperation with Massey-Harris engineers and service men and is approved and recommended by the Massey-Harris Co. A service bulletin No. MH-47 showing the accepted procedure on many service jobs is available, free of charge, on request.

MANUFACTURERS' LITERATURE

16

Aggregate Production, Etc.

The 9th edition of "Facts and Figures," the handy pocket reference booklet published by Pioneer Engineering Works, Minneapolis, Minn., contains factual data and information for contractors, operators and engineers not readily available elsewhere in one volume. Among the subjects covered are aggregate specifications, belt conveyor capacities, crusher settings, horsepower required for various units of equipment, screen data, weights of materials, horsepower rating of belts, safe loads on beams, conversion tables, keys and keyway data, etc.

17

Diesel Powered Equipment

Liberally illustrated with active job scenes, a 16-page booklet has been issued by Caterpillar Tractor Co., Peoria, Ill., showing diesel track-type tractors, equipped with straight or angling type bulldozers, performing pioneering, short haul and heavy road work; equipped with scrapers for medium hauls and leveling; diesel pow-

ered wheel type tractors for high speed, long hauls; and diesel motor graders for haul road maintenance, backsloping and fine finishing. It points also to diesel engine installations in draglines, shovels, compressors and crushing plants.

18

Shovel-Crane

A new catalog has been issued by the Link-Belt Speeder Corp., Cedar Rapids, Ia., presenting a word-and-picture story of their ¾ yard, LS-Seventy shovel-cranes. The catalog is so arranged and illustrated to show how each feature contributes to the working efficiency, the operating economy and long life of the machine.

19

Boring Machine

The McCarthy earth and rock boring machine, designed for drilling holes, horizontal or vertical in removing overburden on highway projects or in open or strip pit mining, is described in a new booklet issued by Salem Tool Co., Salem, O. The booklet contains complete descriptions and illustrations of the machines in action, both horizontal and vertical types. It points out the many outstanding features and time-saving, labor-saving advantages of the self-propelled, truck mounted, and trench-type units.

20

Small Tournapull

A broadside illustrating and describing the new small Tournapull has been issued by R. G. LeTourneau, Inc., Peoria, Ill. The folder explains in detail and pictures the many new design features built into the new self-loading D Tournapull. Large-size, job action photographs show how the Tournapull can be used on small yardage projects. The inside spread gives complete specifications on the one-man-operated rig.

21

Concrete Vibrators

A new 32-page catalog issued by Vyzenbeek & Staff, Inc., Chicago, Ill., contains much new and up-to-date information on the vibration of concrete together with illustrations and complete description of new vibrator machines in the Wyco line including new jackshaft double V-belt drive units.

CONCRETE VIBRATION
is
Our Meat!
If you are looking for the best solution to any specific concrete vibration problem, or on the other hand, you simply want the best vibrator your money will buy, see the nearest JACKSON Distributor or drop us a line. Concrete Vibration is our meat!
For over 25 years we have specialized in the development and manufacture of the most efficient and reliable concrete vibrators for each and every type of concrete construction. And the record of JACKSON equipment in the field clearly demonstrates that that goal has been fully attained. The name "JACKSON" on any vibrator is complete assurance of thorough satisfaction.
The FS-7A ELECTRIC
(READY FOR IMMEDIATE DELIVERY)
Ideal on many types of construction. Built around the lightest, yet most powerful motor we have ever used on equipment of this character. Easy to handle or skid. Takes any of our standard heads up to 2⅜" x 18½" with flexible shafting in 24" to 14' lengths. Delivers up to 10,000 V.P.M. on AC or DC 110-120 Volt. Does many jobs formerly done only with larger machines.
Left: The FS-7A with reduction attachment to provide the most desirable shaft speed for wet or dry rubbing or grinding of concrete.
DAMS MASS CONSTRUCTION
GENERAL CONSTRUCTION
AIRPORTS HIGHWAYS
PIPE MANUFACTURE
TUNNELS HARD-TO-GET-AT PLACES
FORM VIBRATING
JACKSON
JACKSON
INTERNAL—EXTERNAL
ELECTRIC - FLEXIBLE SHAFT - HYDRAULIC
Concrete VIBRATORS
ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

10-TON CULVERT SECTIONS

are "MADE TO ORDER" for this

ROGERS TRAILER

The broad, sturdy deck of this Rogers trailer readily accommodated four huge culvert sections. This 40-ton load was swiftly and easily transported to the construction location.

Write for the catalog illustrating a complete range of sizes and types.

ROGERS BROTHERS CORPORATION
110 ORCHARD STREET ALBION, PENNA.

EXPERIENCE builds 'em PERFORMANCE sells 'em

22

Motor Graders

Two new folders, describing the new "Caterpillar" diesel No. 12 and No. 112 motor graders, have been published by Caterpillar Tractor Co., Peoria 8, Ill. The publications stress construction and operational features of the new machines. The folders are graphically illustrated and include brief specifications of the motor graders.

23

Truck Restrictions

A comprehensive study of the road laws regulating trucks and trailers throughout the United States has been completed by the Research Department of The Four Wheel Drive Auto Co., Clintonville, Wis., and has been compiled in booklet form. The booklet is the 18th edition of the size and weight restrictions to be published by the company since 1933. Publication was suspended during the war when blanket regulations were enacted by the federal government in order to facilitate the movement of war materials, superseding state regulations in most cases. Extreme diligence was exercised by The Four Wheel Drive Auto Co. to eliminate errors in this most recent compilation of laws and regulations limiting the size and weight of trucks and trailers, by securing the cooperation of the officials in each state. These officials have checked and approved the laws of their respective states and the compilation is believed to be correct in every detail.

24

Portable Drinking Fountain

The Dobbins sanitary portable drinking fountain for construction workers is illustrated and described in a circular issued by Dobbins Manufacturing Co., Elkhart, Ind. In this fountain water is completely sealed from dust and dirt, and the heavy insulation prevents water temperatures from rising over 10 degrees in 12 hours in the hottest weather.

25

Air Compressors

The new Air Chief portable compressors are featured in a bulletin of Davey Compressor Co., Kent, O. Bulletin includes photos and detailed mechanical specifications of 60-105-160-210-315 c.f.m. capacity machines. Emphasis is placed on Davey permanent peak efficiency valves. Also included is a complete description of the new equi-balanced crankshaft recently invented by Paul H. Davey, company president.

26

Acetylene Generators and Manifolds

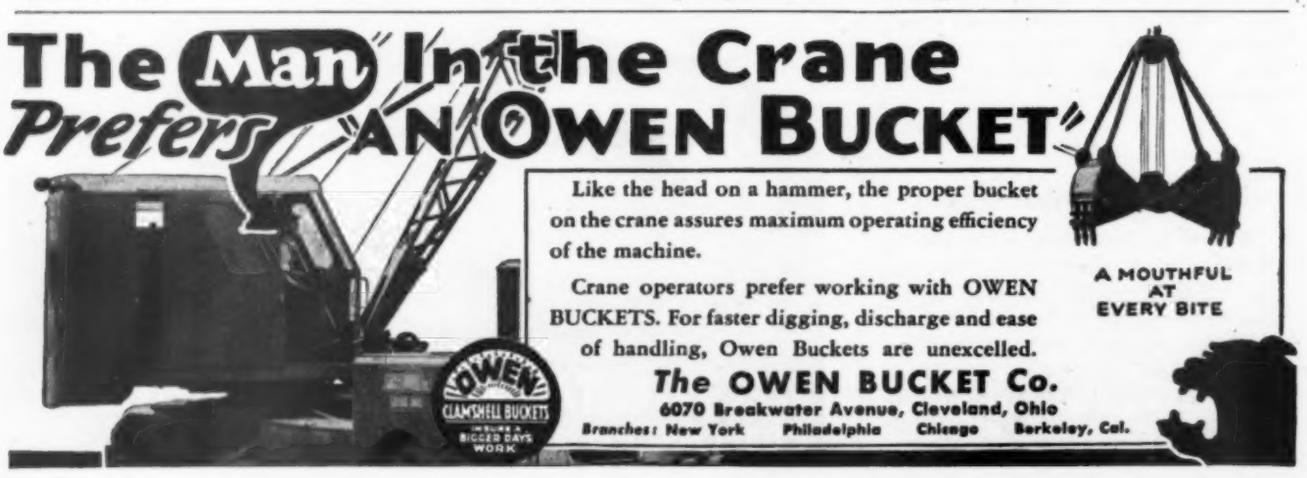
A 22-page catalog listing and explaining the complete line of Airco acetylene generators has been issued by Air Reduction Sales Co., New York, N. Y. The stationary acetylene generators covered are the 300 lb. both single and double rated and the 500 lb. double rated. The portable acetylene generators range in size from 15 to 50 lb. Oxygen manifolds covered include both the duplex-type, designed for use with two individual banks of cylinders and the simplex-type accommodating a single bank of cylinders.

27

Arc Welder

The "Weldmobile," a complete self-propelled gasoline engine driven arc welder, is described in a pamphlet published by Hobart Brothers Co., Troy, O.

The Man In the Crane Prefers "AN OWEN BUCKET"



Like the head on a hammer, the proper bucket on the crane assures maximum operating efficiency of the machine.

Crane operators prefer working with OWEN BUCKETS. For faster digging, discharge and ease of handling, Owen Buckets are unexcelled.

A MOUTHFUL AT EVERY BITE

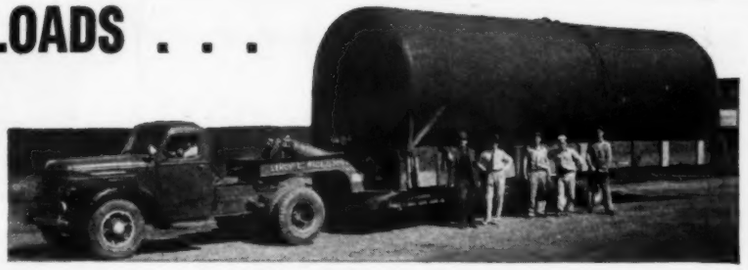
The OWEN BUCKET Co.
6070 Breakwater Avenue, Cleveland, Ohio
Branches: New York Philadelphia Chicago Berkeley, Cal.

SAFE FOR UNUSUAL LOADS . . .

It takes a sturdy, well designed and properly constructed trailer to safely transport unusual and unbalanced loads. Heavy hauling is ALWAYS SAFE with a JAHN TRAILER.

JAHN TRAILERS ALL OVER the WORLD!

Reg. Trade-Mark



Heavy duty trailers from 5 to 100 tons with any wheel or axle combination.

C. R. JAHN COMPANY
1345 WEST 37th PLACE, CHICAGO 9, ILL.

WITH THE MANUFACTURERS & DISTRIBUTORS

Sparks Joins Buda

Fred W. Sparks has joined The Buda Co., Harvey, Ill., as district representative to handle the Ohio territory for the company's engine division. He was formerly with the Euclid Road Machinery Co. at Cleveland, O., as one of their field representatives. Before that he was with the Cummins Engine Co. at Columbus, Ind., for seven years as Ohio regional sales manager and central states manufacturers' sales manager.

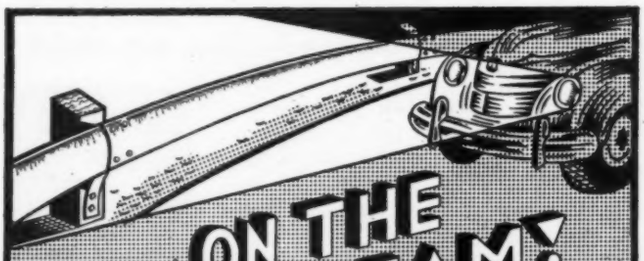
Minton Now Vice President of Koppers

Brig. Gen. Hugh C. Minton, who was named Production Manager of Koppers Co., Inc., on May 10, has been appointed a vice president of the company.

He now becomes responsible for the efficiency of all Koppers' manufacturing operations, dissemination of information on manufacturing methods, advice and consultation on such methods, installation of new and improved systems for manufacturing processes, factory and shop management, and plant development and expansion.

Appointed Export Director

A. H. Jones, well known for many years on the West Coast as manager of the Gardner-Denver Co. branch



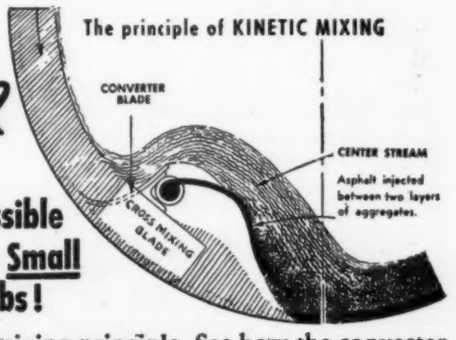
ON THE BEAM!
with
TUTHILL GUARD RAILS

They keep traffic off the shoulders and on the road. Convex, spring-bracket, steel panels absorb and deflect impacts, keep cars from plunging over embankments. Easy to see. They beautify the highway, too; rounded end-pieces give extra neatness.

Choose Tuthill Guard Rails. They are economical to buy, to install, and to maintain. REQUEST DETAILS

TUTHILL SPRING CO.
761 W. POLK STREET, CHICAGO 7, ILLINOIS

THIS MIXER
Makes Possible Bidding on Small Asphalt Jobs!



Look at this mixing principle. See how the converter blade peels off the material and cross mixing blades fold the material in under. Note too that the asphalt is injected in *between* the two streams.

Asphalt is carefully metered and can be mixed in the material in amounts up to 8 gallons in 6 seconds. Kinetic mixing is fast—3 cu. ft. in 30 seconds. It means high speed mixing that permits the fast profitable handling of jobs that are generally a headache. Ask for Bulletin K-100 and let us give you the name of a Foote dealer near you.

See Page 39

THE FOOTE COMPANY, INC.
1936 State Street, Nunda, N. Y.

Concrete

VIBRATORS and GRINDERS

Write for Circular on types, sizes and Prices

ELKHART White Mfg. Co. INDIANA

Try a **Pierce-Bear** *on that tough job!*

3½ TON — VARIABLE WEIGHTS

Engineered refinements and rugged strength have earned for these rollers enviable performance records. Compact design gives efficient operation in close quarters. Ideal for maintenance work on highways, airports and parking areas. Fine for driveways, docks, etc. Easy to operate. They do a good job at low cost.

Write for New Illustrated Folder.

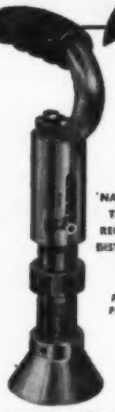
MANUFACTURED BY

Lewis Manufacturing Co. P. O. BOX 500

SAN ANTONIO 6, TEXAS

THE SHOT HEARD 'ROUND THE INDUSTRIAL WORLD!

TEMPOTOOL AMAZING NEW HAND TOOL FASTENS STEEL TO STEEL— STEEL TO CONCRETE OR BRICK



SOLD NATIONALLY THROUGH RECOGNIZED DISTRIBUTORS ONLY

PATENTS PENDING

TEMPOTOOL MODEL 22

TEMPOTOOL • MODEL 38

NO DRILLING!

NO WIRES OR AIR LINES!

COMPLETELY SAFE! WHEN USED IN ACCORDANCE WITH INSTRUCTIONS!

EASY TO USE— CUTS WORKER FATIGUE!

THOROUGHLY TESTED ON MANY JOBS!

TEMPO PRODUCTS COMPANY
409 PERRY-PAYNE BLDG., CLEVELAND 13, OHIO

PRINCIPLE OF OPERATION

Tempotool employs the power of an exploding cartridge to drive "holding studs" into steel or concrete. The tool is fired by pushing the muzzle of the tool sharply against the work.

Tempotool projectiles have a thin flange around the edge of the head which shears off when the tool is fired. This flange, by momentarily confining the gases of the explosion, builds up the terrific pressure which gives the projectiles their high velocity. Despite this power, recoil is amazingly light.

TYPICAL PROJECTILES USED BY TEMPOTOOL

DRIVE PIN

THREADED STUD

INTERNAL THREADED STUD

Other type studs made to order for special jobs.

TEMPOTOOL

TRADE MARK REG. U. S. PAT. OFF.

INTRODUCING A NEW ERA IN HAND TOOLS

office in Los Angeles, has been appointed director of the export office in New York City. He was also elected vice president of the newly formed Gardner-Denver Western Hemisphere Co. with offices in New York.

Mack Appointment

Appointment of Harry Oldham as superintendent of its New Brunswick, N. J., foundry has been announced by Mack Trucks, Inc. One of the motor industry's most experienced foundrymen, Mr. Oldham comes to Mack from the Ford Motor Co., where he was employed for 23 years in various top foundry positions.

Miller Joins Soule

M. E. "Cap" Miller, formerly central sales manager for R. G. LeTourneau, Inc., and more recently with Rozier-Ryan Co., LeTourneau distributor in St. Louis, has joined Soule Equipment Co., Oakland, Calif. Miller is well-known in California, getting his start in the 30's when Stockton was headquarters for LeTourneau.

Kennedy Joins Am. Hoist

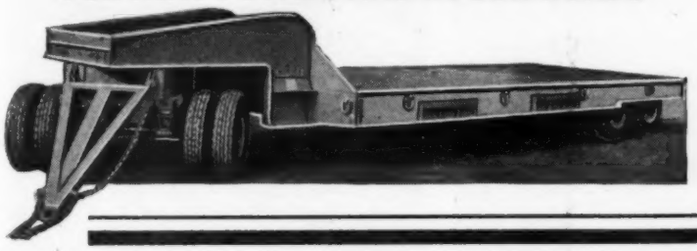
W. T. Kennedy

William T. (Bill) Kennedy has assumed duties as Sales Representative for American Hoist & Derrick Co. in the Southwestern territory. He will make his headquarters at Houston, Texas. Mr. Kennedy has long been associated with the construction industry and is a qualified engineer.

EIGHT Reasons Why - - -
The La Crosse Wide Base Rim is the leader
More tread life . . . . reduced temperature . . . . fewer bead failures . . . less blow out hazard . . . . less sway . . . . compact tread . . . . lower tension . . . . economical operation.
HEAVY DUTY
LA CROSSE TRAILER CORPORATION
LA CROSSE, WISCONSIN
Dealers in 48 states

HUGHES TRAILERS
GIVE UNLIMITED PERFORMANCE—

FOR HEAVY LOADS AND ROUGH ROADS



- Hughes Trailers have a capacity rating of from 15 to 100 tons.
- Hughes Trailers can be had in semi or full trailers with drop or straight deck.

L. J. HUGHES CO.

1029 Brooke Blvd. Reading, Pa.

Lima Opens New Office

A new western office and warehouse has been opened by the Shovel and Crane Division, Lima Locomotive Works, Lima, O. The new offices are located at 1315 Howard St., San Francisco 3, Calif. Paul Fenwick is the district manager for this area. Ralph Rodgers and M. E. Army are the assistant district managers. Mr. Rodgers is located in the San Francisco Office and Mr. Army is located with their Los Angeles sales agent, the Smith Booth Usher Co.

Snow Promoted by Euclid

The Euclid Road Machinery Co., Cleveland, O., has established a sales development department, headed by V. L. Snow. This department will make field engineering studies for the improvement of current Euclid models and the development of new products. It will also prepare material for distributor's use in sales training programs for their personnel. Mr. Snow, who is well-known in the construction equipment industry, joined the engineering department of Euclid in 1935 and served as assistant chief engineer until 1942. At that time he became manager of industrial products, a position he has held until promoted recently to manager of sales development.

Wico Opens New Sales Office

Wico Electric Co., West Springfield, Mass., has opened a sales office at 208 East Wisconsin Ave., Milwaukee, Wis. The office will be staffed by Donald G. Forbes, manufacturing division sales engineer, and Orville H. Tift, trade-sales engineer.

THE QUICKEST WAY TO HEAT THE COLDEST CAR OF ASPHALT . . .

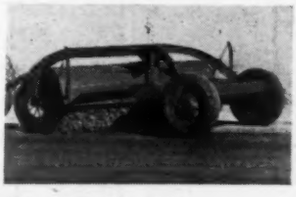
GRACE CIRCULATING TANK CAR HEATERS

Made for Tank Cars . . . will unload asphalt at 250 GPM. Heats 10,000 gal. insulated car 50° or more per hour. Will trail to the job at 40 MPH.

FOR EVERY SWEEPING JOB . . .

GRACE SWEEPERS

For cleaning road base before asphalting, sweeping streets, or for airfields. Available in axle-driven, motor-driven, or front end of tractor types.



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W. E. GRACE MFG. CO.

6005 S. Lamar St. Dallas, Texas

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"Black-Topper"

BITUMINOUS DISTRIBUTORS

ACCURATE...DEPENDABLE...ECONOMICAL

In new road construction or in making those much needed road repairs you'll find an Etnyre "Black-Topper" accurate in distribution, dependable in performance, low-cost in operation. See your Etnyre dealer or write us today for complete details.

E. D. ETNYRE & CO., Oregon, Illinois

Shunk Snow Plow and Ice Removal **BLADES**

Proved record of superior performance. Made of specially developed steel to withstand severe service conditions.

FOR ALL TYPES AND MODELS OF SNOW PLOWS
Various widths, lengths, thicknesses—flat or curved—standard or special—punched ready to fit your machine.

SHUNK SAW-TOOTH ICE BLADE
Amazingly effective. Thoroughly breaks up and removes heavy, slippery ice and snow formations. Replaces all types of snow plow blades or maintenance units. Write for Bulletin and name of nearest Distributor.

Shunk
MANUFACTURING COMPANY
ESTABLISHED 1854
BUCYRUS, OHIO.

CONTRACTORS RUBBER PRODUCTS
available from Stock for immediate Delivery

CONVEYOR, ELEVATOR and TRANSMISSION BELTING
all widths and plies

V-BELTS all sizes

HOSE
all sizes and types

AIR	DISCHARGE	STEAM
FUEL	COMPRESSOR	VACUUM
FIRE	PILE DRIVERS	SUCTION
WATER	ROAD BUILDERS	WELDING

BOOTS, DREDGE SLEEVES, PUMP DIAPHRAGMS, ETC.

. . . and everything rubber for Industrial Requirements

Write for new catalog
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Phone BArclay 7-9793

THEY SPELL "Real Safety" EMBURY
Luck-E-Lite
HIGHWAY TORCHES
Lowest Cost for Highest Dependability

Order through Your Jobber
EMBURY MFG. CO., WARSAW, N. Y.

CLEARING HOUSE

FOR SALE

1—Iroquois Asphalt Plant with 3000# box (shows no wear) $14,000.00
1—Huber 10-ton, 3-wheel roller, gas 900.00
1—Kelly-Springfield 5-ton, 3-wheel roller with scarifier 900.00
2—Bull Clam Drotts (new) both for 700.00
1—Galion 10-ton, 3-wheel roller with 24" wheels 4,000.00
5—Galion tandem rollers (various weights and prices).
1—P & H Crane, Model 200, Serial #1865.... 3,500.00
1—P & H Crane, Model 450, Serial #4116X... 6,000.00
3—Kelly-Springfield steam rollers, two 8-ton, one 10-ton (various prices.)

PHIL H. McGUIRE
P. O. Box 6055, Milan Station, Norfolk 8, Va.

FOR SALE

Barber-Greene ditcher, Model 44C, 18"x5'6" boom, equipped with new Chrysler 8-cylinder, 65 h.p. gasoline motor. Entire machine recently completely rebuilt. Can be inspected vicinity Rantoul, Franklin County, Kansas.

Brundred Oil Corporation
4722 Broadway, Kansas City 2, Missouri

30—10,000 GAL. CAP. R. R. TANK CAR TANKS. CLEANED, TESTED, PAINTED. READY TO SHIP. ATTRACTIVE PRICES. DEALERS PROTECTED.

Telephone Bryn Mawr 1769

L. M. Stanhope
ROSEMONT PENNA.

FOR SALE

CEDAR RAPIDS Asphalt Mixing Plant, 3000 lb. capacity, boilers diesel operated. Storage tanks 35,000 gal. with heating coils. Barber Green Finishing. Etnyre Distributers. Tandem Rollers, etc.

GALLION Tandem Diesel Roller, 8-12 ton, latest model. A-1 ..... $3,000.00
Also 5-8 ton tandem Gallion, gasoline.

ETNYRE Distributor model MX-D5, style RE, 1250 gallons. Brand new. With or without trailer. 20% off reg. price.

BROOKS CH-200 and Dempster Load Luggers, 2 cu. yd., latest models with buckets. A-1. $600 per set.

BARCO Gasoline Hammer with attachments. New. $225.00.

LIPPMANN Portable Crushing and screening plant, on rubber. 10"x20" r.b. Jaw, 24"x10' vibr. screen. Cat. engine. Rebuilt. Like new..... $3,500.00

LIPPMANN 24"x36" r.b. Jaw Crusher, latest model. Long jaws. Weight 32,000 lbs. New.... $8,000.00

BUCYRUS-ERIE 43 B, ser. #11623, Diesel Dragline. 2 cu. yd. 60 ft. boom. A-1..... $9,000.00

BYERS #55½ cu. yd. shovel-dragline-clamshell, incl. buckets and trailer. Overhauled.... $5,500.00

BUDA Diesel Power Unit #6LD 1742. Rebuilt. 180 h.p. Steel skids. Starting engine. Clutch. $3,000.00

MURPHY Diesel Power Unit ME-6, 150 h.p. Skids. Clutch. Like new..... $3,250.00

STERLING 18-ton Truck, 6x4, HB-600 Cummins Diesel. 10 tires, 1200x12. Rebuilt..... $4,500.00

INGERSOLL-RAND 210 cu. ft. 2-stage Portable Compressor, 4-steel wheels. Rebuilt. Guaranteed. $1,750.00.

BUCYRUS-ERIE "Red Arch" 2½ cu. yd. Dragline bucket. Like new. 5500 lb. $775.00

KIESLER N. Gen. purpose 1 cu. yd. Clamshell bucket. Like new $675.00

HENDRIX 3½ cu. yd. Dragline bucket. Good. $850.00

WENZEL MACHINERY RENTAL & SALES CO.
2136 Jefferson Street Kansas City, Mo.

For Sale

1—Littleford Trail-O-Distributor Model 3-C, complete with attaching hose (New) $1,950.00
1—Huber 3-wheel roller, 5 to 7 ton, Buda gas powered $1,400.00

THE LORENZ EQUIPMENT CO.
547 W. Rich St. Columbus 8, Ohio

DUTCH CONTRACTOR WANTS

Relation with American contractor for enlarging of capital and equipment. Many good objects in Holland in execution. Especially Road constructions and utility building. Intermediary of Banks accepted.

Letters to No. 1958 Advt. Bur. "Reclatechnical" Singel, 512. Amsterdam, Holland.

Caterpillar Promotions

E. W. Ryder

E. W. Ryder, heretofore assistant parts manager for the Western Division, has been promoted to the position of parts manager for Eastern Division, Caterpillar Tractor Co., Peoria, Ill. He replaces C. D. Byrns, who resigned as Eastern Division parts manager to join Arizona Machinery Co., "Caterpillar" distributor. W. E. Doersam has been named assistant parts manager for the Western Division. He started in the Parts Department in 1935 and has been a supervisor in the Technical Division for several years.

Bradley Dewey Awarded Medal of Merit

Bradley Dewey, president of the Dewey & Almy Chemical Co., Cambridge, Mass., has received the Medal of Merit, one of the nation's highest awards. Rear Admiral Morton L. Deyo, USN, commandant of the First Naval district, made the presentation in behalf of the Secretary of the Navy. The Medal of Merit was awarded by the President of the United States to Mr. Dewey for his outstanding services to the United States as Deputy Rubber Director from September, 1942, to September, 1943, and as Rubber Director from September, 1943, until September, 1944, and for his services as chairman of the Guided Missiles Committee of the Joint Chiefs of Staff from February, 1945, until May, 1946. The citation accompanying the award was signed by President Truman.

FASTER LOADING, LIFTING, SCRAPING

"The Ottawa" Industrial Hydraulic Front End Loader saves hundreds of man hours on every job. A rugged heavy duty attachment for industrial type tractors that loads bulk materials, does light bulldozing jobs and operates as a portable crane. A year 'round labor saver—will do hundreds of odd jobs better faster. Handles loads up to 4,000 pounds, lifts to a height of 9½ feet. It is shipped complete with super-powered Hydraulic system. Bulldozer, Boom and Snow Plow attachment available to give you maximum productive use of your industrial tractor. Hundreds now in use by contractors, quarries, building material and coal dealers and municipalities.

Write today for prices and illustrated bulletin. Immediate shipment. Fits most models industrial tractors.

The Ottawa INDUSTRIAL HYDRAULIC FRONT END LOADER

OTTAWA STEEL PRODUCTS, INC.
OTTAWA, KANSAS

Universal Atlas Appointments

Effective June 1, the appointments of David S. Day as sales manager, Duluth, Minn.; of P. L. Bowlin as sales manager, Minneapolis, Minn., and of Patrick F. Morrissey as district sales manager, Des Moines, Ia., are announced by F. T. Wiggins, vice-president, Chicago, Universal Atlas Cement Co., United States Steel Corp. subsidiary. Mr. Day began his sales career with the cement company at Chicago in 1907. Mr. Bowlin joined Universal Atlas in 1928 as salesman in Iowa. Mr. Morrissey was employed by Universal Atlas in 1939 as Atlas White Cement representative in Kansas City.

Crusher Co. Has Sound Film

Realizing that stone-crushing equipment cannot be carried and displayed by salesmen, New Holland Manufacturing Co., Mountville, Pa., has just completed production of a 16 mm sound film in color on the new 13-ton 3030 double impeller breaker.

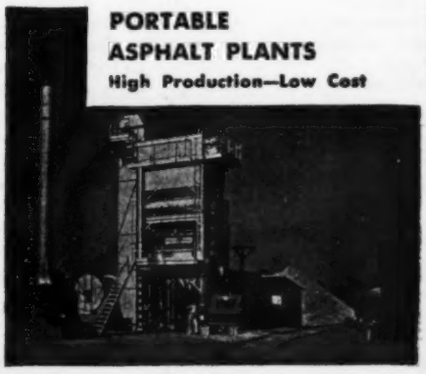
ARIENS AGGMIXER
FOR SECONDARY ROAD CONSTRUCTION

The swirling, chopping action of these tines does a thorough job of mixing, wet or dry.

Here's equipment designed especially for mixed-in-place construction — to operate in connection with other general purpose equipment. Wherever aggregates are used it thoroughly pulverizes, mixes and aerates aggregates with binder—rapidly and economically. Also ideal for soil cement stabilization. Safe and easy to operate . . . adjustable to any tractor . . . made 4 standard sizes, 4', 5', 6' and 7'. Write for details.

ARIENS COMPANY
BRILLION, WIS.

PORTABLE ASPHALT PLANTS
High Production—Low Cost



THE McCARTER IRON WORKS, INC.
NORRISTOWN, PENNA.

RELIANCE
CRUSHING, SCREENING and WASHING UNITS
● Up to 2000 Tons a Day ●

Crushers, Elevators, Sweepers, Screens, Wash Boxes, Bins, Pulverizers, Feeders, Spreaders, Kettles, Conveyors, Drag-Lines "GAYCO", Centrifugal Air Separators

UNIVERSAL ROAD MACHINERY CO.
Kingston, N. Y.
Canadian Representatives: F. H. Hopkins & Co., Ltd. 340 Canada Cement Co., Montreal, Que., Can.

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Check reference to advertisement or to items of equipment or materials on which you wish to receive information. Give your name and address in the space at foot of page (if convenient, please print or use typewriter), detach page and mail to ROADS AND STREETS, Readers' Service Department, 22 West Maple Street, Chicago 10, Ill. We will pass your inquiry along to manufacturers and see that you get desired information promptly.

Check below advertisements on which you wish information on products featured:

*Adams Mfg. Co., J. D.....Inside Front Cover
*Allis-Chalmers, Tractor Division..... 19
American Cable Division.....Third Cover
*Ariens Co. 111
Armco Drainage & Metal Products, Inc... 20
*Austin-Western Co. 33

*Blaw-Knox Co. 13
*Bethlehem Steel Co..... 1
Bucyrus-Erie Co. 43

Carlyle Rubber Co..... 110
Caterpillar Tractor Co..... 77
*Ceco Steel Products Corp..... 4
Chicago Pneumatic Tool Co..... 45
*Cleaver-Brooks Co. 38
*Contractors Machinery Co..... 47

Detroit Diesel Eng. Div..... 40
Diamond Iron Works..... 41
Dietz Company, R. E..... 80

*Electric Tamper & Equip. Co..... 105
*Embury Mfg. Co..... 110
Erie Steel Construction Co..... 44
Etnyre & Co., E. D..... 109
*Euclid Road Machinery Corp..... 11

Firestone Tire & Rubber Co..... 58
*Foote Co. 39-107
Ford Motor Trucks.....23-71
*Four Wheel Drive & Auto Co..... 83

*Gallion Iron Works & Mfg. Co., The..... 9
Gemmer Mfg. Co..... 14
General Tire 73
Gorman-Rupp Co. 21
*Grace Mfg. Co., W. F..... 109
Gulf Oil Corp..... 18

*Hanson Clutch & Machinery Co..... 46
*Harnischfeger Corp. 30
Hazard Wire Rope Division.....Third Cover
*Heltzel Steel Form & Iron Co..... 78
*Hetherington & Berner, Inc..... 8
Hetherington & Berner, Inc..... 8
*Highway Equipment Co..... 103
Hose Accessories Co..... 80
*Huber Mfg. Co., The..... 7
Hughes Trailer Co..... 109
Hyster Co. 54

Independent Pneumatic Tool Co..... 10
*International Harvester Co.....64-65
*Iowa Mfg. Co..... 27

Jackson Vibrators, Inc..... 105
*Jaeger Mach. Co., Inc..... 49
*Jahn Co., C. R..... 107
Johnson Co., The, C. S.....16-17

Koehring Co. 16-17
Kwik-Mix Co. 16-17

*La Crosse Trailer & Equipment Co..... 108
Le Roi Co..... 25
*Leschen & Sons Rope Co., A..... 66
Le Tourneau, Inc., R. G.....28-29
Lewis Mfg. Co., H. W..... 108
*Littleford Bros. 46

Mack Trucks, Inc..... 48
McCarter Iron Works, Inc..... 111
Maxon Construction Co..... 47

Northwest Engr. Co..... 5

*Osgood Co. 37
Ottawa Steel Co..... 111
*Owen Bucket Co., The..... 106

Parsons Co., The.....16-17
Perfection Steel Body Co..... 35
Preformed Wire Rope..... 26

Rogers Brothers Corporation..... 106

*Sauerman Bros., Inc..... 104
*Schramm, Inc. 31
*Shunk Mfg. Co..... 110
Sinclair Refining Co..... 12
Standard Oil, Calif..... 32
Standard Steel Works..... 75
Syntron Co. 104

Tempo Products Co..... 108
*Texas Co., The.....50-Back Cover
Thew Shovel Co., The..... 3
*Timken Roller Bearing Co.....Front Cover
Trackson Co. 6
Truscon Steel Co..... 24
*Tuthill Spring Co..... 107

Unit Crane & Shovel Corp..... 22
United States Steel Co..... 42
Universal Atlas Cement Co..... 42
Universal Engineering Corp..... 15
Universal Road Machinery Co..... 111
Upson-Walton Co., The..... 34

Vulcan Tool Mfg. Co..... 80

War Assets Administration..... 36
Ward La France Truck Div..... 79
Warren-Knight Co. 97
*Wellman Engineering Co., The..... 101
*White Mfg. Co..... 108
Wooldridge Mfg. Co..... 70
Winter-Weiss Co. 101
*Worthington Pump & Machy..... 60

*Advertisers with * are represented in the 1946 edition of Powers Road and Street Catalog and Data Book. Please refer to it for additional information on any of their products.

Check other products below on which you wish us to obtain information for you:

AGGREGATE:
- ☐ Bins and Hoppers
- ☐ Conveyors
- ☐ Crushers
- ☐ Portable Plants
- ☐ Screens

BITUMINOUS:
- ☐ Batchers
- ☐ Finishers
- ☐ Distributors
- ☐ Dryers
- ☐ Heaters
- ☐ Plants (central)
- ☐ Plants (travel)

CONCRETE:
- ☐ Batchers
- ☐ Buggies and Carts
- ☐ Finishers
- ☐ Joints, Expansion and Contraction
- ☐ Reinforcement Accessories
- ☐ Metal Road Accessories
- ☐ Mixers (under 1 yd.)
- ☐ Mixers (1 yd. up)
- ☐ Pavers
- ☐ Reinforcing Steel
- ☐ Road Forms (1000' set)
- ☐ Tower
- ☐ Truck Mixers

CRANES:
- ☐ Crawler Mounted
- ☐ Truck Mounted
- ☐ Piledrivers

GRADERS:
- ☐ Blade, self propelled
- ☐ Blade, pull type
- ☐ Blade, under truck
- ☐ Elevating

LOADERS & TRENCHERS:
- ☐ Front-end loader (tractor mounted)
- ☐ Loader, bucket type and belt type
- ☐ Trencher or Ditcher

HAULING EQUIPMENT:
- ☐ Dump Trucks, self-powered
- ☐ Dump Wagons, tractor drawn
- ☐ Flatbed Trailers
- ☐ Other Trucks

PUMPS:
- ☐ Centrifugal
- ☐ Concrete
- ☐ Diaphragm
- ☐ Mud Jacking
- ☐ Piston
- ☐ Wellpoint

POWER UNIT: (Independent)
- ☐ Gasoline
- ☐ Diesel
- ☐ Electric

ROLLERS:
- ☐ Power (Smooth)
- ☐ Pneumatic Tire
- ☐ Sheepsfoot

TRACTORS:
- ☐ Crawler
- ☐ Rubber-Tired

TRACTOR EQUIPMENT:
- ☐ Dozers
- ☐ Power Control Units
- ☐ Rippers
- ☐ Scrapers, tractor drawn
- ☐ Scrapers, self-powered

BUCKETS:
- ☐ Clamshell
- ☐ Concrete
- ☐ Dragline
- ☐ Orange Peel

SHOVELS & DRAGLINES:
- ☐ Crawler (under 1 yd.)
- ☐ Crawler (1 yd. up)
- ☐ Truck Mounted

ROCK DRILLS & AIR TOOLS:
- ☐ Air Compressors
- ☐ Backfill Tampers
- ☐ Clay Diggers
- ☐ Concrete Vibrators
- ☐ Drills, cabel tool
- ☐ Drills, tripod and wagon
- ☐ Drills, rock, hand-held
- ☐ Paint Sprayers
- ☐ Paving Breakers
- ☐ Riveters and Chippers

MISCELLANEOUS:
- ☐ Buildings, portable
- ☐ Earth Drills, power
- ☐ Light Plants
- ☐ Lubrication, Service Truck
- ☐ Mowers, Highway
- ☐ Power Saws
- ☐ Soil Stabilizing Equipment
- ☐ Snowplows, rotary
- ☐ Snowplows, v or wing
- ☐ Spreaders, sand or cinders
- ☐ Street Flushers
- ☐ Street Sweepers
- ☐ Welders
- ☐ Cutting Torches
- ☐ Hydraulic Jacks
- ☐ Hydraulic Control Equipment
- ☐ Hand Tools
- ☐ Hoists, derrick type

Be sure to fill in name and address below:

Your Name.....Title or profession.....

Name of your company or governmental department.....

Type of work for which equipment will be used.....

Street Address.....

City..... State..... County.....

TRU-LAY Preformed

for SHOVEL ROPES

• More often than not, power shovels give wire ropes a terrific beating. Heavy rocks, coarse gravel, debris of all sorts make the lines quiver with strain. Yet it is on just such service that TRU-LAY Preformed proves its ability to take punishment. Specify it for every shovel service, whether hoist lines, boom lines, thrust, racking and crowding lines, or trip cables.

The ideal wire rope for these applications is TRU-LAY Preformed Improved Plow Steel. In that rope you get the proper combination of strength and toughness, plus fatigue-resistance and smooth spooling that gives better, longer service. Of course, TRU-LAY Preformed comes in all constructions, sizes, lays and centers.

Then, too, you can get prompt help of an experienced American Cable engineer. Every salesman of American Cable wire ropes has the exact specification (construction and grade) for *every* wire rope application. He can save you time and money. Wire or write today.

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Tacoma, Seattle, Bridgeport, Conn.

AMERICAN CABLE DIVISION
AMERICAN CHAIN & CABLE

When heavy-duty pavin is called for—

(above) Constructing a Texaco Sheet Asphalt pavement on an important city street. The mechanical spreader is laying a 1½ inch wearing surface over a 1½ inch asphalt binder course of the same thickness.

(right) For 21 years, this Texaco Sheet Asphalt pavement has served the heavy traffic of Broad Street, Trenton, N. J.

When heavy-duty paving is called for by a street or highway, construct Texaco Sheet Asphalt.

Dense, resilient and rugged, Texaco Sheet Asphalt paving has been closely associated with heavy traffic by street and highway engineers for over 40 years.

Not only does this plant-mixed type of Texaco construction successfully absorb the heaviest impact, but upkeep cost on numerous pavements of this type, down 25 years and longer, has been remarkably low.

Use Texaco Sheet Asphalt to resurface existing worn pavements of various types, in addition to laying it on new foundations.

Where repairs are necessary, particularly when cuts are made to reach underground utilities, such repairs are made quickly and patched areas blend perfectly with the rest of the pavement.

For help with a paving or maintenance problem, call in a Texaco engineer, who is an Asphalt specialist. Write our nearest office.

THE TEXAS COMPANY, Asphalt Sales Dept., 135 E. 42nd Street, New York City 17

Boston 16 Chicago 4 Denver 1 Houston 1 Jacksonville 2 Philadelphia 2 Richmond 19

TEXACO REG. T. M.

TEXACO ASPHAL